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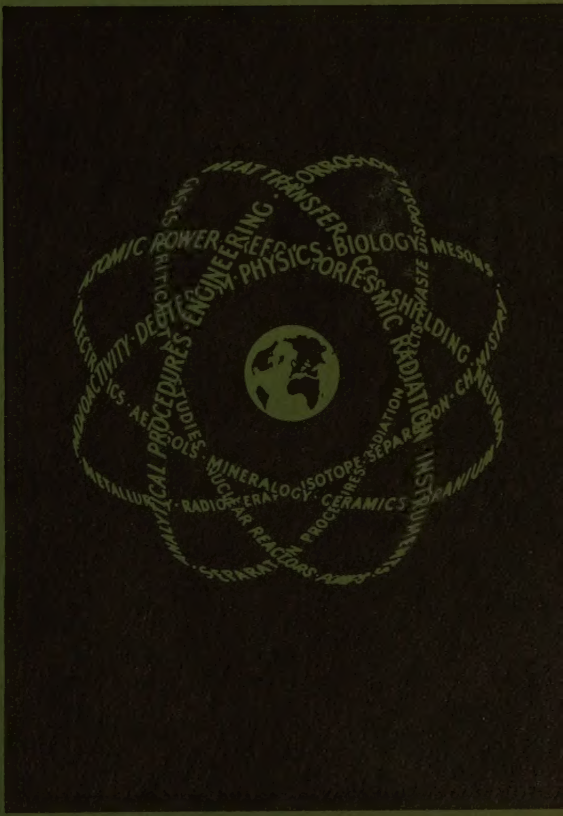

February 15, 1959

Volume 13 Number 3
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NUCLEAR SCIENCE ABSTRACTS

Volume 13 Number 3 February 15, 1959

GENERAL

1036 AEC-tr-3420
EGYPTIAN ATOMIC ENERGY COMMISSION: ITS FORMATION, CONSTITUTION AND PROGRAM. Dec. 1955. Translation of a publication of the Egyptian Atomic Energy Commission. 33p.

The Egyptian Atomic Energy Commission was organized in 1955. A program of preparation and training was instigated, and a delegate to the International Committee and a committee of experts to assist him in Egypt and abroad were appointed. (C.H.)

1037
THE CONSTRUCTION OF CERN. R. Steiger, P. Steiger, H. R. Fietz, and H. Hauri. Atomkern-Energie 3, 375-82(1958) Oct. (In German)

As examples of the problems to be solved in the design and development of the atomic research establishment for CERN, the development of the over-all plan and the design and development of the synchrocyclotron and the proton-synchrotron are described. (J.S.R.)

1038
SUMMARY OF ACTIVITIES [OF] REACTOR CENTRUM NEDERLAND. The Hague, Netherlands, Reactor Centrum Nederland, 1957. 16p.

The main activities of the Reactor Centrum Nederland in 1957 are reviewed. Detailed attention is given to the Research Center now being constructed at Petten. (auth)

BIOLOGY AND MEDICINE

1039 BNL-2304
Brookhaven National Lab., Upton, N. Y.
METABOLIC EFFECTS OF MARKED SODIUM RESTRICTION IN HYPERTENSIVE PATIENTS; COMPARISON WITH TWO NORMOTENSIVE INDIVIDUALS. Lewis K. Dahl, Bernard G. Stall, III, and George C. Cotzias. [1955]. 31p. $6.30(ph OTS); $3.00(mf OTS).

Two white nonhypertensive adults—a male of 25 and a female of 45—were studied both before and during prolonged dietary Na and Cl restriction to levels of about 6 mEq/d and 12 mEq/d, respectively. Except for the affectual response of the female to the regimen, the measured effects were strikingly minimal. The 25 year old male remained on this markedly restricted Na intake for 49 days without symptoms or signs of distress. About three weeks after equal limitation, the behavior of the 45 year old female was suggestive of that found in a mild maniac depressive psychosis. This abnormal emotional pattern persisted, in varying degree, until her discharge from the hospital 56 days after restriction. The normal male had a slight but statistically significant decline in both systolic and diastolic levels of blood pressure on the low Na regimen. The loss of body Na and Cl as measured by isotope dilution studies, did not differ significantly from hypertensives. No specific changes were measured in these two individuals following NaCl limitation which seemed to separate them from patients with essential hypertension. Data are compared with data on hypertensive patients. (C.H.)

1040 BNL-3223
Brookhaven National Lab., Upton, N. Y.
THE EFFECTS OF CHRONIC AND ACUTE EXPOSURES OF IONIZING RADIATIONS ON KALANCHOE "BRILLIANT STAR." Otto L. Stein. [1957?]. 16p. $3.30 (ph OTS); $2.40(mf OTS).

A study was made of the effects of chronic and acute irradiation on the shoot apex of Kalanchoe. This plant was selected because its decussate phyllotaxy and almost naked shoot apex make it a convenient system for morphogenetic experimentation. Response to the two modes of application of ionizing radiation were quite dissimilar. Gross and morphological responses are described and illustrated photographically. (C.H.)

1041 BNL-3800
Brookhaven National Lab., Upton, N. Y.
AGING EFFECT OF TOXIC AND RADIATION STRESSES. H. J. Curtis and K. L. Gebhard. [1957]. 10p. $1.80 (ph OTS); $1.80(mf OTS).

Results are reported from a series of experiments designed to compare radiation-induced aging and natural aging in mice, and insofar as possible to detect the causes of each. The life-shortening effects of radiation were compared with those of various toxic stresses such as tetanus toxin, tetanus toxoid, turpentine, and typhoid vaccine. The effects of massive and chronic exposure and the influence of age were studied. An attempt was also made to test the mutation theory of natural and induced aging. The mice were also given massive and chronic doses of nitrogen mustard and the response studied. Results indicate that general non-specific stresses do not shorten the life span of animals but that radiation does decrease life expectancy markedly. Results of these studies did not confirm the somatic mutation theory of aging. (C.H.)

1042 BNL-3803
Brookhaven National Lab., Upton, N. Y.
LIFE EXPECTANCY IN RATS AFTER SINGLE WHOLE

BODY EXPOSURES TO SLOW NEUTRONS OR X-RAYS. L. F. Nims, J. Geisselsoder, R. Thurber, and L. Lewis. [1958]. 3p. $1.80(ph OTS); $1.80(mf OTS).

Presented at International Congress of Radiation Research in Burlington, Vermont, [Aug. 1958].

The effects of exposure to a single whole-body dose of slow neutrons or x radiation on the life span of rats were investigated for three dose ranges. Below 250 r very few animals died within three months of exposure. In the range of 250 to 800 r the main effect of increasing the dose of radiation was to alter the ratios of acute deaths to chronic deaths. Above 800 r all deaths were acute deaths which occurred within three months of exposure. (C.H.)

1043 NYO-2058

Western Reserve Univ., Cleveland. Atomic Energy Medical Research Project.

A COMPARISON OF THE EFFECTS OF RADIOACTIVE INTERNAL EMITTERS AND X-RAYS ON ANTIBODY FORMATION. Paul R. Salerno, and Hymer L. Friedell. May 1, 1958. 18p. Contract W-31-109-eng-78. $0.75 (OTS).

A threshold dose of 390 r of total-body x rays was found to suppress the capacity of the rat to synthesize antibody in reaction to antigen injected during the period 2 to 20 days post irradiation. Large doses of P^{32} do not significantly reduce the ability of the rat to synthesize antibody to sheep erythrocytes. Colloidal Au^{198} injected six days before treatment with antigen resulted in partial suppression of antibody formation. Combinations of P^{32} with x rays or with Au^{198} did not result in enhancement of depressant action on antibody synthesis. Combined treatment with sub-optimal doses of x rays and Au^{198} resulted in greatly increased but incomplete suppression of antibody production. X rays must be delivered to the total-body in order to produce suppression of antibody synthesis and this effect is independent of the adrenal gland. (auth)

1044 NYO-2366

Roscoe B. Jackson Memorial Lab., Bar Harbor, Me.

THE OCCURRENCE OF CHROMOSOMAL ABERRATIONS IN PRE-SPERMATOCYTIC CELLS OF IRRADIATED MALE MICE. Progress Report [for] January 1, 1958—August 31, 1958. Allen B. Griffen. 11p. Contract AT(30-1)-2113. $3.30(ph OTS); $2.40(mf OTS).

Male mice which were subjected to irradiation of the testes showed an initial period of good fertility which persisted for approximately one month after the irradiation. The fertile period was followed by one of sterility whose duration varied with the radiation dose. During the sterile period spermatogenesis ceased and spermatogonia were scarce or absent. Six to eight weeks after irradiation a period of renewed fertility began and continued throughout the remainder of the life span. Offspring sired by irradiated male mice during the post-sterility period of renewed fertility were bearers of major chromosomal aberrations. Results indicate that after irradiation there is no safe period during which offspring may be sired which are free from aberrations. (C.H.)

1045 ORO-179

Texas. Univ., Austin.

EFFECTS OF IONIZING RADIATIONS ON GROWTH RESPONSES, METABOLISM AND ELECTRICAL PATTERN OF AVENA COLEOPTILES AND EARTHWORMS. Sept. 30, 1958. 11p. Contract AT(40-1)-1750. $3.30 (ph OTS); $2.40(mf OTS).

The effects of ionizing radiations on growth, metabolism, and electrical pattern were studied in Avena coleoptiles and in earthworms. Results published in scientific journals are summarized, and recent findings are discussed. (C.H.)

1046 TID-3514

Technical Information Service Extension, AEC.

RADIOISOTOPES IN MEDICINE AND HUMAN PHYSIOLOGY. A Selected List of References. J. A. McCormick, comp. Aug. 1958. 124p. $2.75(OTS).

This bibliography contains 2862 references on uses of radioisotopes in diagnostic medicine, therapeutic medicine, clinical research, human physiology, general medical research, and immunology. The references were taken from the 1948 to 1956 open literature. A list of the journals from which the references were selected and an author index are included. (auth)

1047 UCRL-8456

California. Univ., Berkeley. Radiation Lab.

LIFE SPAN OF INDIVIDUAL YEAST CELLS. Robert K. Mortimer and John R. Johnston. Sept. 17, 1958. 7p. Contract W-7405-eng-48. $0.50(OTS).

A group of 36 single diploid yeast cells was followed microscopically to observe the maximum number of buds that each could produce. A distribution between 9 and 43 buds was observed, with a median of 24 buds. From the nature of this distribution and the relative sizes of bud scars and cell surface, it is proposed that life-span limitation is a consequence of accumulation of bud scars until the useful surface area was insufficient to maintain normal metabolic processes. (auth)

1048 UR-527

Rochester, N. Y. Univ. Atomic Energy Project.

RECOVERY FROM A SINGLE DOSE OF X-RAY IN OLD AND YOUNG RATS. John B. Hursh and George W. Casarett. July 9, 1958. 21p. Contract W-7405-eng-49. $4.80(ph OTS); $2.70(mf OTS).

Rats received a large single dose of whole-body x ray followed by a test dose at an interval of 2, 5, and 8 days. Mortality in 30 days was measured and recovery from the first dose was calculated. Rats aged 546 days recovered at a rate no less rapid than that of 107 day old rats. The implication of the recovery data is briefly discussed. (auth)

1049 UR-529

Rochester, N. Y. Univ. Atomic Energy Project.

IRRADIATION OF THE GASTROINTESTINAL TRACT OF THE RAT BY INSOLUBLE BETA EMITTERS. William E. Rothe and L. W. Tuttle. June 1957. 81p. Contract W-7401-eng-49. $2.00(OTS).

Phosphorus-32 labeled particulate chromic phosphate was administered, by gavage, to rats as a source of gastrointestinal beta irradiation. A method of calculating the resultant dose-rates to the various segments of the gastrointestinal tract was formulated; and dose-rates were calculated for each group of irradiated animals. Groups of rats received daily administrations of CrPO$_4$, containing 100, 200, or 400 microcuries of P-32, for periods of 5, 10 and 30 days. These animals, and their allied controls, were subjected to clinical and histological examinations to determine the biological effects of local beta irradiation on the gastrointestinal tissues. Rats, of the Long-Evans strain, were found to tolerate daily radiation dosages ranging from 100 rep to the stomach, to 25 rep to the cecum, for periods of 10 days, without evidence of immediate damage. The cecum was shown to be the critical tissue of the gastrointestinal tract of the rat, following the ingestion of insoluble beta emitters. Daily radiation dosages as high as 260 rep to the stomach, and 84 rep to the cecum, produced moderate atrophic and degenerative changes in the gastrointestinal mucosa, with a complementary loss of body weight, and a reduction of the numbers of circulating lymphocytes. Animals receiving the above dose-rates for a period of 10 days were found to return to a clinically sound condition by 14 days post irradiation. The data are discussed in terms of possible applicability to situations in which humans were to ingest insoluble beta emitters under emergency conditions. It is tentatively concluded that present emergency permissible levels of contamination based upon low acceptable risk of injury to hematopoietic tissue are also acceptable insofar as beta particle injury to the gastrointestinal tract are concerned. (auth)

1050 UR-533
Rochester, N. Y. Univ. Atomic Energy Project.
RELATIONSHIPS BETWEEN BURN SEVERITY AND THE SIMULATED THERMAL PULSES OF VARIOUS NUCLEAR WEAPONS. Bernard Lerman and J. Raymond Hinshaw. Aug. 7, 1958. 23p. Contract W-7401-eng-49. $0.75(OTS).

When burns are produced by a total radiant exposure of 5 cal/cm^2, burn severity decreases with thermal pulses of longer duration. Maximum damage results from a pulse simulating that of a 20 KT weapon, the shortest pulse investigated; 40 KT and 100 KT weapon pulses show similar effects; and the 1000 KT pulse produces less damage. Burn severity is nearly the same from 10 cal/cm^2 whether the thermal pulse simulates 20 KT, 40 KT, 100 KT, or 1000 KT weapons. Less damage is caused by 10 cal/cm^2 when it is delivered with a 10,000 KT simulated pulse. There is surprisingly little difference in the range of severity of burns from 15 cal/cm^2 when the thermal pulse simulates 100, 1000, and 10,000 KT weapons. Most of the burns from radiant exposures of 20 cal/cm^2 show complete destruction of the full thickness of dermis. If there is a difference due to the type of thermal pulse, it is that the 100 KT pulse results in less damage than does either the 1000 or 10,000 KT pulse. When the radiant exposure is sufficient to produce some dermal damage but not great enough to destroy the full thickness of the skin, a moderately wide range of burn severity results from each exposure-pulse combination. This again demonstrates that skin is not a passive receiver but reacts to thermal energy. The type of reaction influences the severity of the burn produced. (auth)

1051 UR-536
Rochester, N. Y. Univ. Atomic Energy Project.
LOCALIZATION OF I^{131} LABELED ANTIBODY TO RAT FIBRIN IN A TRANSPLANTABLE RAT LYMPHOSARCOMA. Irving L. Spar, Ruth L. Goodland, and William F. Bale. Oct. 9, 1958. 11p. Contract W-7401-eng-49. $3.30(ph OTS); $2.40(mf OTS).

Rabbits were immunized with rat fibrin and the resulting antisera clotted with normal rat plasma. From the clot a substance was isolated and labeled with I^{131} that showed a strong tendency to bind to rat fibrin clots formed in its presence. This substance, presumably an antibody to rat fibrin, when injected intravenously into rats bearing the transplantable Murphy-Sturm lymphosarcoma localized with a high degree of preferentiality in this tumor. (auth)

1052 USNRDL-TR-259
Naval Radiological Defense Lab., San Francisco.
RESIDUAL INJURY INDUCED IN THE ERYTHROPOIETIC SYSTEM OF THE RAT BY PERIODIC EXPOSURES TO X-RADIATION. S. J. Baum and E. L. Alpen. Oct. 10, 1958. 31p.

Rats were irradiated periodically in order to assess any remaining injury of previous exposures after a 3 month interval. One group of female and one of male rats were subjected to 300 r x rays, 250 kvp, while another group of females was exposed to 400 r, 250 kvp. A significant decrease in Fe^{59} incorporation was observed with each periodic exposure in all 3 experimental groups. These decreases were logarithmic. A titration experiment based on the additional acute dose necessary to mimic the effects of periodic x ray exposures indicated an approximate 30% residual injury after one repeated irradiation to either 300 or 400 r and 43% after 2 exposures. In contrast to the bone marrow changes, peripheral erythroid decreases were small until the last period in the two female radiation groups as measured by the hematocrits. This indicates that the quantity of stem cells available for erythrocyte production must greatly exceed the number required in the daily red cell turnover. It must be questioned whether rats with an impaired erythrocyte proliferation system could respond to emergency situations as well as normal animals. Other observations included relatively early appearance of mammary tumors in the female rats and weight decreases in all groups immediately after radiation. These changes were however not unique in irradiated rats because they eventually appeared in old controls. (auth)

1053 AEC-tr-3376
TAGGED ATOMS IN THE STUDY OF PLANT NUTRITION AND USE OF FERTILIZERS: CONFERENCE TRANSACTIONS. (Mechenye Atomy v Issledovaniyakh Pitaniya Rastenii i Primeneniya Udobrenii: Trudy Soveshchaniya). V. M. Klechkovskii, A. V. Sokolov, and V. M. Zezyulinskii, eds. Translated from a publication of the Publishing House of the U.S.S.R. Academy of Sciences, Moscow, 1955. 234p. $2.75(OTS).

In 1954 the USSR Academy of Sciences convened a conference for the discussion of applications of radioactive and stable isotopes in agrochemical and soil studies. Emphasis was on the uptake and utilization of phosphorus by plants, calcium uptake and utilization, and nitrogen exchange in plants. Factors influencing the uptake of fertilizers following various application methods were discussed. Other topics discussed include the role of rhizosphere microorganisms in plant nutrition, the causes and means of reducing the falling of ovaries in cotton plants, the effect of soil temperature on plant utilization of various nutrient elements, and applications of radiocalcium in studies of exchange reactions in soils. (C.H.)

1054 AEC-tr-3426
CHANGES IN THE BLOOD OF THE RAT FOLLOWING TOTAL BODY IRRADIATION WITH EITHER X-RAYS OR GAMMA RAYS. W. Dittrich, G. Hohne, and H. J. Schmermund. Translated for Los Alamos Scientific Lab. from Strahlentherapie 90, 78-87(1953). 9p.

A comparative study of the effect of total-body irradiation with either 180 kev x rays or 4 Mev gamma rays has shown that following irradiation of rats with 400 r the counts of erythrocytes, leukocytes, and lymphocytes dropped initially and then gradually approached the starting values. Differences in results produced by the two types of radiation were too small to be significant. Following irradiation with doses between 100 and 400 r reticulocyte counts dropped initially and then rose far above the starting values. Differential counts indicated a shift to the left and the occurrence of pathological cell forms. The extent of these radiation-induced changes in the blood picture may have been a function of the total dose applied (in r or rep), but does not appear to have been a function of differences in ion pair formation by x rays or gamma rays. (auth)

1055 AEC-tr-3428
COMPARATIVE STUDIES ON THE DAMAGE INDUCED IN ESCHERICHIA COLI BY X-IRRADIATION (180 KEV) AND GAMMA IRRADIATION (31 MEV) IN ZURICH. Jean Lindenmann. Translated for Los Alamos Scientific Lab. from Oncologia 6, 1-26(1953). 18p.

Radiation damage curves were determined for E. coli subjected to x-irradiation (180 kev) and to gamma irradiation (31 Mev). Irradiation was carried out inside a plexiglas cassette. The dose was determined with the aid of a Victoreen Condenser-rate-meter. The results have been evaluated statistically with the use of probit analysis. Both curves were statistically identical within the experimental error. The half-lethal dose (LD_{50}) amounted to 2480 r, the 95% fiducial limits being 2370 and 2590 r. The sensitivity of the experimental procedure was such that a difference of 7% in the half-lethal doses would have been detected with certainty. (auth)

1056 AEC-tr-3429
II. CHROMOSOMAL CHANGES IN BARLEY SEEDLINGS BROUGHT ABOUT BY ELECTRON BOMBARDMENT WITH A 6 MEV BETATRON. H. J. Shmermund, H. Bleek, and H. L. Heinrich. Translated for Los Alamos Scientific Lab. from Strahlentherapie 81, 177-86(1950). 8p.

To determine the relative biological effectiveness of gamma rays from a 6 Mev betatron, comparative studies were carried out on the biological action of varying doses of gamma rays (4 Mev betatron) and x rays (HWS 0.25 mm Cu) on the progress of mitosis in barley roottip cells. The frequency of occurrence of chromosomal fragment and bridge formations in cells in anaphase and telophase was used as a index of radiation damage. It was shown that the number of radiation-induced structural changes increased with increasing dosage of either type of radiation. However, gamma rays were shown to be less effective than x rays per unit dose used. This difference in effectiveness is attributed to differences in ion pair formation and in the size of groups of ion pairs that are designated as hits. It was concluded on the basis of the dosage curves that in both types of radiation a formal number of 3 to 5 hits is required. (auth)

1057 AEC-tr-3442
DIFFERENCES IN THE BIOLOGICAL EFFECT OF CONVENTIONAL AND ULTRAHARD RADIATION. F. Wachsmann. Translated for Los Alamos Scientific Lab. from Strahlentherapie 81, 273-80(1950). 7p.

It is pointed out that the new betatron radiations (ultrahard x rays and high-speed electrons) are likely to produce different biological effects as compared with the radiations used till now, not only because of their more uniform dose distribution in tissues, but also because of their small ion pair density. These differences are not only quantitative in nature. Because different test objects are affected differently by these radiations, it seems reasonable to expect that a certain amount of electivity will be encountered. Examples are cited where differences in the time of action of the radiations (killing of tadpoles) suggests differences in the locus of action. Similarly differences in the effect on reticulocyte values suggest differences in the mechanism of action of these two radiations. Treatment of vaccinia tumors with identical doses of conventional x rays and high-speed electrons showed clearly that the latter, with their lower density of ion pair formation, had a more desirable effect on tumor regression and protection of surrounding healthy tissues than the more densely ionizing 200 kv x rays. (auth)

1058 AEC-tr-3443
THE PRODUCTION OF RECESSIVE SEX-LINKED LETHAL FACTORS IN DROSOPHILA MELANOGASTER BY MEANS OF 30 MEV ELECTRONS AND 180 KEV X-RAYS. A. J. Shenfield. Translated for Los Alamos Scientific Lab. from Oncologia 10, 281-94(1957). 9p.

This investigation dealt with the relative effectiveness of irradiation at 3000 r with either conventional x rays from a 180 kev stable voltage generator or 30 Mev electrons from a 31 Mev betatron on immature male sperm cells of Drosophila melanogaster that had been irradiated 5 to 11 days prior to fertilization. The Muller-5 technic was employed and the number of lethal and sublethal factors obtained was determined in the F_2 generation. Irradiation with high-speed electrons produced an incidence of 6.07% of lethal factors, that with x rays an incidence of 5.18%, the former thus showing a 17% greater effectiveness. Statistical analysis of these results failed to show any significant difference between the two types of radiation. The number of sublethal factors produced was too small to allow any definite statements to be made. Our results show that high-speed 30 Mev electrons appear to have the same as or slightly greater mutagenic action than 180 kev x rays. Additional experiments are required before definite conclusions can be drawn. (auth)

1059 UCRL-Trans-367
CONSIDERATIONS ABOUT THE FIRST CARBOHYDRATES FORMED IN THE PHOTOSYNTHETIC PROCESS. M. V. Turkins. Translated for Univ. of Calif. Radiation Lab., Berkeley from Doklady Akad. Nauk S.S.S.R. 115, 1142-5(1957). 6p.

The formation of carbohydrates from $C^{14}O_2$ during photosynthesis was investigated in several plants with different types of carbohydrate exchange mechanisms. Data are tabulated. (C.H.)

1060
SYMPOSIUM ON NOXIOUS EFFECTS OF LOW LEVEL RADIATION. PHYSICAL ELEMENTS AND BIOLOGICAL ASPECTS, LAUSANNE, MARCH 27-29, 1958. Bull. schweiz. Akad. med. Wiss. 14, 297-622(1958). (In English, German, and French)

Various aspects of the extensive research carried out during recent years on radioactive fall-out from nuclear test explosions are reviewed. The biological importance of fall-out is discussed. Results are summarized from a number of investigations into the long-range diffusion and deposition of fall-out particles. Data are tabulated on the skeletal distribution of strontium-90 throughout the world. The somatic effects of low-intensity radiation are discussed for different levels of biological organization. The position of research at the present time on the genetic effects of radiation and the danger to human heredity from ionizing radiation is reviewed. A method is presented for estimating the genetic risks of ionizing irradiation in man. Data on the possible relationship between the radiation dose and the incidence of leukemia in man are reviewed. Methods for measuring the effects of radiation on biological systems are discussed. (C.H.)

061

TUDY OF IODINE METABOLISM IN THE RAT BY AN SOTOPIC EQUILIBRIUM METHOD: TOTAL IODINE ENEWAL SPEED OF THE ORGANISM UNDER ARIOUS PHYSIOLOGICAL CONDITIONS. F. Morel nd Cl. Simon. *Compt. rend. soc. biol.* *151*, 1106-10 1957). (In French)

Male rats were fed a diet deficient in iodine, but they eceived in their drinking water a known amount of po-assium iodide. At the beginning of the experiment, the odide in the water was replaced by a daily injection of odide marked with I^{131}. The total radioactivity of the nimal was measured externally each day. At the end f the experiment, the animals were killed and the mount of radioactivity in the thyroid and the skin was ieasured. In one series of experiments the rats also eceived a daily injection of thiouracile. The injection vith the antithyroid started 15 days after the beginning f the injections with radioiodine. The results showed hat the quantity of iodine renewed each day increases vith the amount of iodine in the diet. On the contrary, his quantity is not affected by the thiouracile. (J.S.R.)

062

FFECT OF X RADIATION ON THE AMOUNT OF ROPERDINE SERUM IN THE RAT. Alice Verain, rnest Despaux, and Andre Verain (Laboratoires de Bactériologie et de Physique Medicale, Alger). *Compt. end. soc. biol.* *152*, 592-5(1958). (In French)

The effect of x radiation on the amount of properdine n rat serum was studied *in vivo* and *in vitro*. White ats were submitted to 1000 r, and the amount of pro-erdine before and after irradiation was determined. erum *in vitro* was irradiated with 1 to 2 Mr. The esults showed a rapid, almost constant, decrease of he properdine in the irradiated rat. This effect was ound *in vitro* only when large radiation doses were sed. (J.S.R.)

063

N THE ANTIRADIATION PROTECTIVE EFFECT OF UBSTANCES BLOCKING THE TRANSPORTATION OF XYGEN BY HEMOGLOBIN. E. Ya. Graevskii and M. M. onstantinova (Severtsov Inst. of Animal Morphology, cademy of Sciences, USSR). *Doklady Akad. Nauk.* *122*, 81-4(1958) Sept. 21. (In Russian)

The data indicated that the protective effects resulting rom prophylactic introduction of sodium nitrate or rom inhaling carbon oxide before or after irradiation re conditioned by hypoxia produced in organisms as the esult of the substances blocking the transportation of xygen by hemoglobin. (R.V.J.)

064

EFFECTS OF CORTISONE AND ETHYLENEDIAMINE-ETRAACETIC ACID ON DEPOSITION OF PROMETHIUM (Pm^{147}). B. Kawin (Michigan State Univ., . Lansing). *Experientia* *14*, 373-5(1958).

Young adult female white rats which were injected vith radioactive promethium (Pm^{147}) were treated with he calcium salts of (ethylenediamine) tetraacetic acid nd/or cortisone. The treatment increased the blood oncentration of Pm^{147} a little. EDTA treatment reduced he amount of promethium in the liver by about 20%, but n other typical soft cellular tissue and in the femur one of the treatments altered the general distribution f Pm^{147}. The autoradiographic observations showed hat the local distribution of Pm^{147} is similar to that of ther lanthanide elements. (auth)

1065

OBSERVATIONS ON THE INCORPORATION OF ^{32}P BY IRRADIATION PRODUCED GIANT CELLS. S. Levine and D. Kritchevsky (American Cyanamid Co., Pearl River, N. Y. and Wistar Inst. of Anatomy and Biology, Philadelphia). *Exptl. Cell Research* *15*, 422-3(1958) Oct.

Results of studies on the incorporation of phosphorus-32 by irradiation-induced giant cells of HeLa in tissue culture indicate that the increase in size of the irradiated cells is caused by continued synthesis of large molecules in cells that have lost their ability to divide. (C.H.)

1066

THE POTENTIAL CONTRIBUTION OF ATOMIC ENERGY TO DEVELOPMENT IN AGRICULTURE AND RELATED INDUSTRIES. R. A. Silow (Food and Agriculture Organization of the United Nations, Rome). *Intern. J. Appl. Radiation and Isotopes* *3*, 257-80(1958) Aug.

Potential contributions of atomic energy to agriculture and food production are surveyed. Topics discussed include direct applications of atomic energy for power production, food preservation and processing, and in plant breeding programs. Applications of radioisotopes in agricultural research and in related fields such as soil fertility and crop nutrition investigations, crop production research, livestock production research, fisheries research, and human nutrition research are reviewed. (C.H.)

1067

THE EFFECT OF CHRONIC GAMMA IRRADIATION ON MOUSE OVARIES. E. N. Kopylova (Inst. of Genetics, Academy of Sciences, USSR). *Izvest. Akad. Nauk S.S.S.R. Ser. Biol.*, No. 5, 592-6(1958) Sept.-Oct. (In Russian)

Chronic irradiation with small doses of gamma rays (0.05, 0.1, 0.2, and 0.4 r) caused, in female mice of strain 57 (black), a quantitative decrease of all groups of follicles, in the body cavity. This is particularly apparent in the group of mice irradiated with the largest daily dose of 0.4 r. Despite vast tissue injury individual ovaries contained a small number of cavity developing and primordial follicles of normal structure. Chronic irradiation did not cause the formation of ovarial tumors although eventually proliferation of the germinal epithelium and of the lutein stroma was recorded. Chronic irradiation with small doses did not affect the weight of the body or the ovaries. (tr-auth)

1068

IMMUNOGENETIC STUDIES ON X-IRRADIATED MICE TREATED WITH HOMOLOGOUS HEMATOPOIETIC CELLS. Michael Feldman and David Yaffe (Weizmann Inst. of Science, Rehovoth, Israel). *J. Natl. Cancer Inst.* *21*, 697-712(1958) Oct.

An analysis was made of the immune reactions taking place in x-irradiated mice treated with homologous hematopoietic cells. The results of experiments with hybrid combinations of hosts and donors suggest that the grafted cells react immunologically against the isoantigens of the irradiated recipient. The production of anti-C3H agglutinins by the inoculated C57BL cells was demonstrated by the transfer of lymph nodes from the irradiated and treated C3H mice back to normal C57BL mice. The "cytotoxic" anti-host immune reaction responsible for the lethal "secondary disease" of homologously treated mice was demonstrated by the passive transfer of transplantation immunity produced by the isoantigens of the recipient. Bone marrow from irradiated C3H mice treated with C57BL cells conferred on other irradiated C3H mice a much shorter survival time than normal C57BL cells. It is concluded that the cells from the C57BL-treated C3H donors were immunologically activated by the primary C3H hosts and killed the secondary C3H hosts through an immunologically secondary response. The mortality of mice treated with mixed embryonic isologous and adult homologous cells indicates that even if, theoretically, a delayed antigraft response is feasible, the graft antihost response has a dominant role in the immunogenetic incompatibility. An attempt to overcome this incompatibility was made by injecting irradiated C3H mice with fetal C57BL liver cells. The increased survival time obtained in this experiment may suggest a method for the application of the principles of biological protection to animals of genetically heterogeneous populations. (auth)

1069

ULTRAVIOLET MICROSCOPY OF X-IRRADIATED INTESTINE. Yevette S. Lewis, Henry Quastler, and George Svihla (Argonne National Lab., Lemont, Ill. and Brookhaven National Lab., Upton, N. Y.). J. Natl. Cancer Inst. 21, 813-23(1958) Nov.

The color-translating ultraviolet microscope was used to study radiation effects in the mouse intestine. Generative cells showed pronounced changes in light absorption at 263 mμ; the light-absorbing clumps normally present in the nucleus disappeared. Later, diffuse, strong absorption was seen in cytoplasm and nucleus; still later, there was very little absorption. The earlier changes occurred uniformly in all generative cells and thus cannot be related to a stage in the mitotic cycle; the late changes were independent of resumption of mitosis. The principal cells had similar but much less pronounced changes in 263 mμ absorption. Later, changes occurred that were related to abnormal development. The Paneth cells showed similar changes in 263 mμ absorption. In addition, they showed early degeneration of a specific (secretory) cytoplasmic structure, followed by speedy recovery. (auth)

1070

THE HIGH-ENERGY PROTON BEAM AS A NEUROSURGICAL TOOL. Borje Larsson, Lars Leksell, et al. (Univ. of Uppsala). Nature 182, 1222-3(1958) Nov. 1.

Results of extensive animal experiments show that with a high-energy proton beam a sharply delineated lesion can be made at any desired site in the central nervous system. (C.H.)

1071

EFFECT OF NITROUS OXIDE ON THE RADIOSENSITIVITY OF MOUSE EHRLICH ASCITES TUMOUR. Michael Ebert and Shirley Hornsey (Hammersmith Hospital, London). Nature 182, 1240(1958) Nov. 1.

Nitrous oxide was found to be effective in blocking the effect of oxygen on the radiosensitivity of Ehrlich ascites tumor cells. (C.H.)

1072

DIRECT ABSORPTION OF DISSOLVED STRONTIUM-90 AND YTTRIUM-90 BY TADPOLES OF RANA TEMPORARIA. J. W. Lucas and D. C. Pickering (College of Tech., Liverpool). Nature 182, 1242-3(1958) Nov. 1.

One hundred tadpoles absorbed in one week about 18% of the strontium-90 and about 72% of the yttrium-90 from water treated with 0.125 μc of strontium-90 added to 500 ml water. (C.H.)

1073

INCREASED SURVIVAL OF RATS IRRADIATED WITH X-RAYS AND TREATED WITH PARATHYROID EXTRACT. R. H. Rixon, J. F. Whitfield, and T. Youdale (Atomic Energy of Canada, Ltd., Chalk River, Ont., Can.). Nature 182, 1374(1958) Nov. 15.

An increase in the survival time of irradiated rats was noted when parathyroid extract was given either before or after irradiation. (C.H.)

1074

THE DISTRIBUTION PATTERN OF RADIO CERIUM Ce^{144} IN THE ORGANS OF THE WHITE MOUSE. Ernst Spode and Friedrich Gensicke. Naturwissenschaften 45, 117(1958). (In German)

White mice were injected subcutaneously and intraperitoneally with 3 μc of Ce^{144} as the chloride. Activity determinations were made of the blood, lungs, liver, spleen, pancreas, kidney, femur, and, as far as possible, the bladder urine at intervals of 1, 3, 6, and 24 hours and 3, 7, 14, and 30 days after the injection. The results are tabulated. (J.S.R.)

1075

THE DISTRIBUTION OF CARRIER-FREE RADIO LANTHANUM La^{140} IN MOUSE ORGANISMS. Ernst Spode and Friedrich Gensicke. Naturwissenschaften 45, 135-6(1958). (In German)

White mice received subcutaneous and intraperitoneal injections of carrier-free La^{140} as the chloride. Activity determinations were made of the blood, lungs, liver, spleen, pancreas, kidneys, femur, and urine at intervals of 1, 3, 6, and 24 hr and 3 and 7 days after the injections. The results are tabulated. (J.S.R.)

1076

EFFECTS OF VACUUM POLARIZATION SCATTERING IN THE TREATMENT OF PROTON-PROTON SCATTERING DATA. Michiel de Wit and Loyal Durand, III (Yale Univ., New Haven). Phys. Rev. 111, 1597-1603 (1958) Sept. 15.

The effects of including vacuum polarization scattering in angular momentum states with $L > 0$ and of employing the relativistic value of the Coulomb scattering parameter η_r rather than its nonrelativistic value η were considered in the analysis of low-energy p-p scattering data. It was found that about half of the apparent mean P-wave phase shift present in published data, in the energy range 1.8 to 4.2 Mev, should be attributed to this vacuum polarization scattering. A further decrease in magnitude of the P wave is obtained when η_r is employed, rather than η. Both the vacuum polarization scattering in states with $L > 0$ and the employment of η_r rather than η result in a contribution to the f function which does not vary linearly with energy. The effects of these contributions on the coefficients of a polynomial expansion of f in powers of E are ascertained with reference to p-p scattering data in the energy range 0.2 to 7.5 Mev. The object of the work is more that of investigating the possible magnitude of effects on conclusions drawn from data due to applying the various corrections than that of deriving final phase-shift values. (auth)

1077

ABSORPTION OF NATURAL RADIOACTIVE ELEMENTS BY SOIL MICROORGANISMS. N. A. Krasilnikov. Priroda No. 9, 97-9(1958) Sept. (In Russian)

Tests were made of the absorption of radioactive salts (radium chloride and uranium and thorium nitrates) by soil microörganisms. (R.V.J.)

1078

ATTEMPTS TO PRODUCE LOCALIZED SHWARTZMAN REACTION IN SEVEN SPECIES OF ANIMALS. Douglas E. Johnstone, Sol M. Michaelson, Lawrence Tuttle, and Joe W. Howland (Univ. of Rochester School of Medicine and Dentistry, N. Y.). Proc. Soc. Exptl. Biol. Med. 99, 15-16(1958) Oct.

The localized Shwartzman reaction was produced in 62% of 265 New Zealand albino rabbits, using 3 different toxins (a meningococcal agar washings toxin, a partially purified polysaccharide toxin prepared from a culture of Serratia marcescens, and a crude Serratia marcescens agar washing toxin). Using these same toxins, localized Shwartzman reactions could not be induced in 15 Macacca mulatta monkeys, 20 mongrel dogs, 16 guinea pigs, 15 Wistar albino rats, 16 small swine, and 4 Toggenburg goats. One post-partum lactating female goat developed a typical generalized Shwartzman reaction, i.e., renal cortical hemorrhagic necrosis. (auth)

1079

INFLUENCE OF ENDOCRINE GLANDS ON RADIATION-INDUCED HYPERPIGMENTATION IN MICE. Walter C. Quevedo, Jr. and Douglas E. Smith (Argonne National Lab., Lemont, Ill.). Proc. Soc. Exptl. Biol. Med. 99, 72-5(1958) Oct.

C57BL and LAF_1 mice became hyperpigmented in the extremities when exposed daily to gamma radiation. This process was not significantly altered by adrenalectomy, castration, or daily treatment with ACTH. Hypophysectomized black rats, x-irradiated weekly, developed hyperpigmentation at the same rate as controls. Although it would appear that induction of hyperpigmentation by radiations is largely free of endocrine control, daily treatment of gamma irradiated mice with large doses of cortisone will suppress pigment formation. (auth)

1080

METABOLISM OF Sr^{90} IN ADULT BEAGLE DOGS. Betsy J. Stover and David R. Atherton (Univ. of Utah, Salt Lake City). Proc. Soc. Exptl. Biol. Med. 99, 201-5 (1958) Oct.

Retention and plasma concentration of Sr^{90} in young adult beagle dogs has been determined for 2 years following a single intravenous injection. Retention (% dose) follows the power function (t in days) $R = 70.9\ t^{-0.198}$. Comparison of these results with those from similar studies with Ra^{226} shows the anticipated similarity in metabolism of Sr^{90} and Ra^{226}. However, there are real differences. Sr^{90} retention is less than that of Ra^{226} even though Ra^{226} is excreted more efficiently. This results from higher Sr^{90} plasma concentration. Since Sr^{90} deposits mainly in the skeleton and its daughter Y^{90} does not translocate, this retention equation can be used to calculate average skeletal dose rates for these dogs. (auth)

1081

THE EFFECT OF IONIZING RADIATIONS AND SUBSTRATE PROTECTION ON TYROSINASE. Henry T. Yost, Jr., Dwight W. Fitterer, Jr., and Howard Goldin (Amherst Coll., Mass.). Radiation Research 9, 411-21 (1958) Oct.

Data are presented which indicate a specific protection of tyrosinase by its substrates. Explanations of this protective action are discussed. It appears that there are two sites of enzyme activity on the tyrosinase molecule and that the cresolase site has a much higher affinity for its substrate than the catecholase site. It is suggested that the end product of the catecholase reaction is the protective agent and that it has a higher affinity for the enzyme than does catechol. (auth)

1082

THE TIME INTERVAL AFTER PULSED IRRADIATION WITHIN WHICH INJURY TO BACTERIA CAN BE MODIFIED BY DISSOLVED OXYGEN. I. A SEARCH FOR AN EFFECT OF OXYGEN 0.02 SECOND AFTER PULSED IRRADIATION. II. THE HYPOTHESIS THAT THE OXYGEN EFFECT INVOLVES A CARBON RADICAL: AND THE TIME TAKEN BY OXYGEN TO DIFFUSE TO AND REACT WITH SUCH A RADICAL. P. Howard-Flanders and D. Moore (Hammersmith Hospital, London and Univ. of California, Berkeley). Radiation Research 9, 422-37(1958) Oct.

An investigation was made of the radiosensitivity of the dysentery bacillus Shigella flexneri to a short pulsed irradiation with 1.2-Mev electrons delivered either before or after a sudden change in oxygen pressure. Results show that the stage in the development of the radiation injury at which oxygen may intervene does not extend for as long as 0.01 second after irradiation. The nature of this stage was investigated and an hypothesis is presented for the mechanism of radiation injury. (C.H.)

1083

THORON EXHALATION IN RADIOTHORIUM-BURDENED BEAGLES. C. W. Mays, R. Haldin, and M. A. Van Dilla (Univ. of Utah, Salt Lake City). Radiation Research 9, 438-44(1958) Oct.

In dogs injected with Th^{228} or Ra^{228}, only a small fraction of the thoron atoms formed in the body are exhaled. In Th^{228}-injected dogs, the fraction of thoron exhaled decreases as time after injection and injected dose increase. In Ra^{228}-injected dogs, the fraction of thoron exhaled in even less than that in Th^{228}-injected dogs. (auth)

1084

AN AFTEREFFECT OF IONIZING RADIATION ON A MUTANT OF ESCHERICHIA COLI. Howard I. Adler (Oak Ridge National Lab., Tenn.). Radiation Research 9, 451-8(1958) Oct.

A study is being made of the effect of ionizing radiation on a mutant of Escherichia coli Monod that requires hemin for the synthesis of porphyrin-containing enzymes. If growth occurs in the absence of hemin and the cells are consequently catalase and cytochrome-negative, a postirradiation inactivation is observed. This aftereffect is caused by the low concentration of hydrogen peroxide formed by irradiation in the medium surrounding the cells that survive the immediate effects of irradiation; it is not observed in unirradiated cells. This suggests that irradiation sensitizes these cells to hydrogen peroxide. (auth)

1085

RELATIVE BIOLOGICAL EFFECTIVENESS OF VARIOUS QUALITIES OF RADIATION AS DETERMINED BY THE ELECTRORETINOGRAM. Norman A. Baily and Werner K. Noell (Roswell Park Memorial Inst. Buffalo). Radiation Research 9, 459-68(1958) Oct.

The acute and irreversible effects on the electroretinogram were used to determine the relative biological effectiveness of 100-kvp, 250-kvp, and 2000-kvp x-rays on the rabbit's visual cells. The results obtained by this method are similar to those obtained by histological determination of cell death. In this system, the relative biological efficiency was found to increase with decreasing linear energy transfer. The average values determined were 0.722 ± 0.011 for 100 kvp x rays, 1.00 for 250-kvp x rays, and 1.30 ± 0.02 and 1.31 ± 0.08 for x rays generated at 2000 kvp when the radiation was presented to the eye anterior-posteriorly and posterior-anteriorly, respectively. (auth)

1086

SPECIES DIFFERENCES IN RESPONSE TO HIGH RADIATION DOSES. Howard L. Andrews (National Cancer Inst., Bethesda, Md.). Radiation Research 9, 469-77 (1958) Oct.

Survival times have been studied in mice, rats, guinea pigs, and hamsters at doses up to the point where irradiation times become an appreciable fraction of total survival time. Guinea pigs and mice show sharp discontinuities in the dose-survival time curves. Above this transition, where signs of central nervous system injury predominate, log (survival time) is linear with radiation dose. Rats and hamsters show a similar logarithmic response from the end of the 3- to 5-day plateau. Two human cases from Hiroshima have been found suitable for inclusion. (auth)

1087

A COMPARISON OF THE EFFECTS OF RADIOACTIVE INTERNAL EMITTERS AND X-RAYS ON ANTIBODY FORMATION. Paul R. Salerno and Hymer L. Friedell (Western Reserve Univ. School of Medicine, Cleveland). Radiation Research 9, 478-86 (1958) Oct.

A threshold dose of 390 r of total-body x rays was found to suppress the capacity of the rat to synthesize antibody in reaction to antigen injected during the period 2 to 20 days postirradiation. Large doses of P^{32} do not significantly reduce the ability of the rat to synthesize antibody to sheep erythrocytes. Colloidal Au^{198} injected 6 days before treatment with antigen resulted in partial suppression of antibody formation. Combinations of P^{32} with x rays or with Au^{198} did not result in enhancement of depressant action on antibody synthesis. Combined treatment with suboptimal doses of x rays and Au^{198} resulted in greatly increased but incomplete suppression of antibody production. X rays must be delivered to the total body in order to produce suppression of antibody synthesis and this effect is independent of the adrenal gland. (auth)

1088

QUANTITATIVE RELATION OF RBE IN TRADESCANTIA AND AVERAGE LET OF GAMMA-RAYS, X-RAYS, AND 1.3-, 2.5- AND 14.1-Mev FAST NEUTRONS. Alan D. Conger, M. L. Randolph, C. W. Sheppard, and Helen J. Luippold (Oak Ridge National Lab., Tenn.). Radiation Research 9, 525-47 (1958) Nov.

The relative effectiveness of Co^{60} γ-rays, x-rays, and 14-Mev D, T, 2.5-Mev D, D, and cyclotron 1-Mev average-energy fast neutrons in causing chromosomal aberrations in the plant Tradescantia have been compared. A conservative estimate of the over-all accuracy in these experiments is 15% for physical values, 20% for biological values, and 20% for average LET values as defined here; it is believed that actually the over-all accuracy for all three factors is considerably better than this. Track average and energy average LET's are derived for each radiation in order to make comparisons of RBE against LET. The assignment of proper LET values and subsequent comparisons are relatively simple and straightforward when the ionization generated in tissue is substantially homogeneous. When tissue ionization is not homogeneous, but is made up of components of quite different average LET, the comparison is more complex because each separate component contributes a different relative amount to total dose, total track length, and total biological effect. For these cases, the biological and physical role of each component should be considered separately. RBE was compared against average LET for the radiations used, and to higher LET of α-particles and the heavy particles from the D, T neutron irradiation. RBE increases smoothly and about sevenfold from γ-rays to 1-Mev average-energy cyclotron neutrons (track average LET range from 0.27 to 27 kev/μ), peaks somewhere between 1-Mev fast neutrons and α-particles in the average LET range of 50 to 70 kev/μ at an RBE of 8 to 11, and then falls toward the higher-LET α-particles and D, T heavy particles. Within the fast-neutron energy range, from 14-Mev D, T to 1-Mev cyclotron to 2.5-Mev D, D, neutrons (track average LET of 12, 27, and 31 kev/μ), RBE increases threefold. The shape of the curve of RBE against LET for chromosomal aberrations, an effect that may be considered as cellular cytogenetic lethality, is very similar to the curve for a galaxy of mammalian effects including lethality. In absolute amount, chromosomal RBE's are greater than those for mammalian lethality. (auth)

1089

RELATIVE BIOLOGICAL EFFECT OF 14-Mev NEUTRONS WITH THE BROAD BEAN ROOT (VICIA FABA) AS A TEST SYSTEM. J. F. Spalding, S. B. Hawkins, and J. A. Sayeg (Los Alamos Scientific Lab., N. Mex.). Radiation Research 9, 548-51 (1958) Nov.

Lethality of the broad bean root was used as a test system to determine the RBE of 14-Mev neutrons. The LD$_{50}$ dose of 14-Mev neutrons was 125.9 ± 9.6, and the LD$_{50}$ dose of γ-rays from Co^{60} was 401.4 ± 21.2. When the γ-ray LD$_{50}$ was used as a base line, the RBE for 14-Mev neutrons was found to be 3.18 ± 0.32. (auth)

1090

A SHORT-LIVED EFFECT OF X-IRRADIATION ON RUBIDIUM ABSORPTION BY EXCISED MUNG BEAN ROOTS. T. Tanada (U. S. Dept. of Agriculture, Beltsville, Md.). Radiation Research 9, 552-9 (1958) Nov.

The immediate effect of x irradiation on subsequent Rb absorption by excised mung bean root sections was investigated. X irradiation of the first-centimeter sections was found to bring about a transient decrease in Rb absorption. Rb absorption by the second-centimeter sections was highly resistant to x-ray effects. When the second-centimeter sections was placed in deionized water for 24 hours, however, their Rb-absorbing mechanism also became sensitive to x irradiation. This phenomenon was completely prevented when the suspending medium contained Ca. Mg also exerted some preventive effect. K and Na had no such effect. When the first-centimeter sections or the 24-hour water-treated second-centimeter sections were placed in a Ca solution just prior to or immediately after irradiation Ca appeared to interact with the x-ray effect in such a way so as to further decrease Rb uptake. The effect of x irradiation was reversed to a large degree by the cells within a few minutes after irradiation. Pretreating the 24-hour water-treated root sections with high concentrations of K and Na immediately before irradiation appeared to protect them against the effect of x irradiation on Rb absorption. (auth)

1091
A COMPARATIVE HISTOLOGICAL STUDY OF DUODENAL DAMAGE PRODUCED BY FISSION NEUTRONS AND Co^{60} GAMMA-RAYS. S. Lesher and H. H. Vogel, Jr. (Argonne National Lab., Lemont, Ill.). Radiation Research 9, 560-71(1958) Nov.

The duodenum of female mice was compared histologically and cytologically after exposure to fission neutrons (350 rads) and Co^{60} γ-rays (1000 rads), doses sufficiently high to kill 90% in a 30-day period after irradiation. The duodenum of mice exposed to γ-irradiation recovers completely, and the mice live beyond the critical 3.5 to 6 day period of the intestinal syndrome. The duodenum of mice exposed to fission neutrons is severely damaged, and less than 50% live beyond the 6-day period. Damage to the small intestine plays a dominant role in these early deaths. There is a close relationship between the degree of intestinal damage, generalized bacterial infection, and time of death. Irradiation with fission neutrons produces a high percentage of irreparable chromosome breaks and leads to a prolonged delay in cell division. The comparison of duodenal damage and recovery rate suggests an RBE (n/γ) greater than 6 for intestinal sensitivity. (auth)

1092
RESPONSES OF THE DEVELOPING FETAL NERVOUS SYSTEM TO ROENTGEN IRRADIATION. Roberts Rugh (Columbia Univ., New York). Radiology 71, 729-31 (1958) Nov.

While the embryo and the fetus are more radiosensitive than is the adult organism, particularly because of the abundance of highly sensitive neuroblasts, it does have a reserve of undifferentiated and less sensitive precursor cells which, under the control of organismic influences, can help to maintain the normal topography of the individual. Following x-irradiation, the resultant organism will be deficient, particularly in neural elements, but the functional consequence of this deficiency will depend on the stage of development and on the degree of insult. Because of these factors, the x-irradiation of the human embryo or fetus should be discouraged, particularly during the first trimester. (auth)

CHEMISTRY

General

1093 AECD-4274
Los Alamos Scientific Lab., N. Mex.
PREPARATION AND SOME REACTIONS OF α-HYDROXY-β,β-DINITROPROPIONIC AND -BUTYRIC ACIDS. W. E. McQuistion, M. Schwartz, L. Goodman, and L. W. Kissinger. Sept. 1956. Decl. Mar. 5, 1958. 17p. Contract W-7405-Eng-36. $3.30(ph OTS); $2.40 (mf OTS).

α-Hydroxy-β,β-dinitropropionic and -butyric acids were prepared by condensation of dinitromethane and 1,1-dinitroethane with glyoxylic acid. Some of their chemical and physical properties are described. (auth)

1094 AECU-3845
Kansas. Univ., Lawrence.
COLORIMETRIC DETERMINATION OF BORON WITH VICTORIA VIOLET. Charles A. Reynolds. [1958]. 12p. Contract [AT(11-1)-83, Project No. 1]. $3.30(ph OTS); $2.40(mf OTS).

In the pH range of 7.7 to 10.0, the absorbance of the dye, Victoria Violet, is markedly lowered by the presence of boric acid. A simple colorimetric method for boron in the range of 0.02 to 0.60 mg was developed based on this decrease in absorbance. Measurements were made at 540 $m\mu$ on solution adjusted to pH 8.75. (auth)

1095 AECU-3857
Los Alamos Scientific Lab., N. Mex.
RELAXATION TIMES FOR FAST REACTIONS FROM PHASE LAG MEASUREMENT: PHASE LAG AS A MEASURE OF ENTROPY GAIN. S. H. Bauer. [1955]. 34p. Contract [W-7405-eng-36]. $6.30(ph OTS); $3.00 (mf OTS).

A limiting factor in the study of fast reactions is the speed with which such systems can be displaced from equilibrium, or the speed with which transients thus produced can be followed. It is well known that the most sensitive feature which characterizes a periodic process (given the frequency) is its phase. Phenomena which depend on the appearance of a phase lag between two types of response within a system to an external perturbation are now recognized as useful ones for the study of fast reactions. However, their applicability is limited. Attention is called to a well known but little exploited technique whereby one measures the phase lag between an impressed perturbation and some response within the system, this phase lag being due to the presence of damping processes, which are generally positive. For the case of a single reaction and a simple harmonic perturbation, the relaxation time is $\tau = \tan \phi_1/2\pi\nu$, where ϕ_1 is the phase lag (in radians) and ν is the frequency (per sec) of the perturbation. The lower limit for measurable lifetimes is thus set by smallest measurable ϕ_1, which is of the order 10^{-3}, even for fairly noisy signals. (auth)

1096 AECU-3874
Michigan State Univ., East Lansing.
INFRARED DISPERSION WAVELENGTHS FOR SOLID LiF CONTAINING VARYING PROPORTIONS OF LITHIUM ISOTOPES. D. J. Montgomery and R. H. Misho. Oct. 17, [1958]. 3p. Contract [AT(11-1)-400]. $1.80(ph OTS); $1.80(mf OTS).

The infrared dispersion wavelengths of Li^6F^{19} and Li^7F^{19} have recently been obtained. The study was extended to lithium fluorides containing varying proportions of the lithium isotopes. LiF was prepared by the action of F on metallic Li and its oxide, nitride, etc., resulting from exposure to the atmosphere. The enrichment of the Li^6 sample was specified as 99.3 ± 0.2%, and that of the Li^7 as 99.8 ± 0.1%. Powdered samples of the appropriate composition were evaporated from a platinum boat into a $^3/_4$-mil polyethylene sheet. The thickness of the LiF film, as measured by the a-c conductivity of a known volume of distilled water in which a fiduciary portion of the film plus sheet had been steeped, was about 0.2μ. Infrared spectra were obtained by use of a Perkin–Elmer model 21 double-beam spectrophotometer with a CsBr prism. The results for the wavelength of the transmission minimum as a function of isotopic composition are shown graphically. (A.C.)

1097 ANL-5925
Argonne National Lab., Lemont, Ill.
A REVIEW OF THE UNCLASSIFIED LITERATURE ON NICKEL FLUORIDE. Robert K. Steunenberg. Oct. 1958. 31p. Contract W-31-109-eng-38. $1.00(OTS).

A review of the unclassified literature on nickel fluoride is presented. Pertinent physical and chemical data are listed along with a bibliography containing 114 references. (auth)

1098 CF-56-8-61
Oak Ridge National Lab., Tenn.
PREDICTION OF THE THERMAL CONDUCTIVITY OF FUSED SALTS. W. R. Gambill. Aug. 10, 1956. Decl. Sept. 26, 1958. 10p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

A method for predicting thermal conductivities of fused salts and salt mixtures at their melting points was developed. It allows for the atomic or lattice portion arising from the short-range order present in liquids, and the ionic portion arising from a drift of ions and subsequent energy transfer between the atoms. (J.R.D.)

1099 CF-57-4-115
Oak Ridge National Lab., Tenn.
OPERATION OF THE DISTILLATION METHOD FOR THE DETERMINATION OF SODIUM OXIDE IN NaK DURING THE CALIBRATION OF A PLUG INDICATOR. R. D. Peak. Apr. 30, 1957. 50p. Contract [W-7405-eng-26]. $9.30(ph OTS); $3.60(mf OTS).

The distillation method (Argonne Sampler) for the analysis of sodium oxide in NaK was used to calibrate a plug indicator. The description of the equipment, procedure, and experiences with the Argonne Samplers are presented in great detail to aid future users of this method. Although this method is not very precise, it has been thoroughly checked out and is recommended as a standard means for sampling and analysis for oxide in liquid metal systems. (auth)

1100 CF-58-10-15
Oak Ridge National Lab., Tenn.
SPECTROGRAPHIC ANALYSIS OF NORMAL HUMAN TISSUE FROM SEATTLE AND TACOMA, WASHINGTON. I. H. Tipton, M. J. Cook, J. M. Foland, Johanna Rittner, Michael Hardwick, and K. K. McDaniel. Oct. 6, 1958. 52p. $9.30(ph OTS); $3.60(mf OTS).

Data are tabulated on the chemical content of human tissue as determined by spectrographic analysis. (C.H.)

1101 CF-58-10-43
Oak Ridge National Lab., Tenn.
EXPLOSION OF EBWR ALLOY IN BOILING CONCENTRATED NITRIC ACID. F. G. Baird, T. A. Gens, and L. M. Ferris. Oct. 9, 1958. 3p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

An explosion which occurred while dissolving EBWR core alloy (93.5% U—5.07% Zr—1.5% Nb) in boiling concentrated nitric acid is described. (auth)

1102 CRDC-805
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
RAPID SIMULTANEOUS DETERMINATION OF Pu-IV AND Am-III IN NITRIC ACID SOLUTION. T. Bruce. Aug. 1958. 13p. (AECL-699). $0.50(AECL).

A rapid method for the separation and determination of Americium(III) and Plutonium(IV) was developed. Zirconium is added to the solution to be analyzed as a carrier for the plutonium, and phenyl arsonic acid is added as a precipitant. The zirconium together with the plutonium is precipitated, leaving the americium in the supernatant phase. The americium and plutonium are then determined by alpha counting. The americium values obtained are about 5% high and the plutonium values are low by a like amount. Precision obtained is about ±2%. The report is divided into two principal parts. Part A describes development of the analytical method using synthetic solutions made from standard americium and plutonium solutions. Part B describes the application of the procedure to a process solution. (auth)

1103 IGO-AM/S-44
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE ABSORPTIOMETRIC DETERMINATION OF CHROMIUM IN URANIUM METAL. 1958. 7p.

The sample is dissolved in nitric acid. The solution is filtered and the bulk of the free acid removed by evaporation to dryness. The residue on evaporation is dissolved in dilute sulfuric acid, silver nitrate is added as catalyst and the chromium is oxidized by boiling with ammonium persulfate solution. Excess persulfate is decomposed by further boiling and after cooling and diluting, the chromium in the solution complexed using diphenyl carbazide, the absorbancy of the complex being measured by means of the Spekker fitted with Ilford 605 filters. The portion insoluble in nitric acid is treated with perchloric acid and the chromium is oxidized by boiling after the addition of potassium bromate to the nitric acid solution. The excess potassium bromate is decomposed by the addition of sodium chloride and the chromium is determined absorptiometrically using diphenyl carbazide as described for the chromium soluble in nitric acid. (auth)

1104 IGO-AM/S-49
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
A RAPID METHOD FOR THE ABSORPTIOMETRIC DETERMINATION OF IRON IN URANIUM METAL. 1958. 9p.

The metal is dissolved in hydrochloric acid and hydrogen peroxide. Excess peroxide is removed by treatment with sodium sulfite. Iron is determined absorptiometrically as its thioglycollic acid complex which is developed in the presence of ammonium carbonate and ammonium citrate. The method was devised specifically for use in a laboratory in which there is a regular and frequent demand for this determination. The cleansing procedure, the "solution acid" and the use of a composite reagent are the factors introduced to permit results from a set of eight determinations to be reported within 1 to 2 h. (auth)

1105 IGO-AM/S-119
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
THE ABSORPTIOMETRIC DETERMINATION OF MANGANESE IN URANIUM METAL. 1958. 6p.

The sample is dissolved in nitric acid and the manganese extracted using chloroform, as the diethyl dithio carbamate complex. The organic matter is destroyed by wet oxidation and the manganese is oxidized to permanganate with potassium periodate. The permanganate color is measured absorptiometrically. The method is applicable for manganese concentrations of from 1 to 40 ppm and probably higher. Throughout the range 1 to 25 ppm the results tend to be 10 to 15% low. (auth)

1106 IGO-AM/S-122
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.

THE ABSORPTIOMETRIC DETERMINATION OF PHOSPHORUS IN URANIUM METAL. 1958. 6p.

The sample is dissolved in nitric acid and just neutralized with ammonia. Acidified ammonium molybdate converts the phosphorus to phosphomolybdic acid which is reduced with stannous chloride to "Molybdenum Blue" and the latter measured absorptiometrically. The method is applicable from about 1 to 10 ppm. Arsenic must be absent but up to 500 ppm of silicon does not interfere. (auth)

1107 ISC-851

Ames Lab., Ames, Iowa.

QUANTITATIVE SEPARATION OF SMALL AMOUNTS OF RARE EARTHS FROM THORIUM, URANIUM, AND ZIRCONIUM BY ION EXCHANGE. Henry John Hettel and V. A. Fassel. Dec. 1956. 71p. Contract W-7405-eng-82. $2.00(OTS).

A successful method has been developed for the determination of certain rare earths in thorium in the fractional ppm range. The procedure is based on the ion-exchange chromatographic separation of the rare earths plus added yttrium carrier from the thorium, followed by emission spectrometric determination of the rare-earth impurities in the yttrium carrier. A simultaneous separation from the rare earths of the common element impurities present in the thorium has been accomplished. A high degree of compensation for procedural errors is achieved by the use of a pure rare earth as both the carrier in the separation and purification procedure and the matrix material in the spectrographic determination. The method fulfills the requirements of accuracy, sensitivity, and speed necessary for use in the routine analysis of reactor-grade thorium metal. It can find application, in its present form, also for the simultaneous determination of part-per-billion amounts of common element impurities in thorium. (auth)

1108 ISC-1014

Ames Lab., Ames, Iowa.

ELUTION OF COPPER AND NEODYMIUM FROM A CATION-EXCHANGE RESIN WITH AMMONIA-ETHYLENEDIAMINETETRAACETIC ACID SOLUTIONS. Lyle K. Matson and F. H. Spedding. Dec. 1957. 53p. Contract W-7405-eng-82. $1.50(OTS).

Several experiments were performed eluting neodymium bands behind copper bands, and a few other experiments were performed eluting only copper bands using dilute ammonia—EDTA solutions. The charge balance equations, material balance equations, and mass action equilibria were written for both the copper band and the neodymium band. Equations were also indicated for the material balance at the boundary of an ideal system and compared with the experimental results. A number of retaining beds are described including one which gave some degree of true equilibrium. (J.R.D.)

1109 K-1298

Oak Ridge Gaseous Diffusion Plant, Tenn.

VAPOR PRESSURE MEASUREMENTS FOR THE SYSTEM: URANIUM HEXAFLUORIDE—CHLORINE TRIFLUORIDE. W. C. Kuykendall. Nov. 20, 1956. Decl. Sept. 8, 1957. 11p. Contract W-7405-eng-26. $3.30 (ph OTS); $2.40(mf OTS).

Vapor pressures for the system uranium hexafluoride—chlorine trifluoride at approximately 76, 83, and 92°C over the entire composition range are reported. Vapor pressure and gross composition data indicate that the system exhibits complete miscibility. At 75°C vapor pressures of 128 and 32 psia were observed at compositions of 0 and 1.0 mole fraction uranium hexafluoride, respectively. The smooth curve within these limits shows a maximum positive deviation from a Raoult's law relationship of approximately 13 pounds occurring at 0.4 mole fraction uranium hexafluoride. (auth)

1110 LA-387(Del.)

[Los Alamos Scientific Lab., N. Mex.]

SPECTROCHEMICAL ANALYSIS OF PLUTONIUM AND ITS COMPOUNDS. II. THE CUPFERRON PROCEDURE. N. H. Nachtrieb, H. A. Potratz, O. R. Simi, S. Wexler, and B. S. Wildi. [Sept. 14, 1945]. Decl. July 19, 1957. 33p. Contract [W-7405-eng-36]. $6.30(ph OTS); $3.00 (mf OTS).

A method is described whereby milligram samples of iron, antimony, vanadium, tantalum, titanium, niobium, zirconium, tin, bismuth, uranium, or plutonium may be analyzed for parts per million of thirty-nine impurity elements. The procedure consists in forming the acid-insoluble cupferride of one of the above elements and extracting the compound from the impurities by means of chloroform. The aqueous solution containing the impurities is evaporated on copper electrodes which are sparked to produce the impurity spectrum. (auth)

1111 LA-1063

Los Alamos Scientific Lab., N. Mex.

DETERMINATION OF COBALT, NICKEL, AND COPPER IN THE PRESENCE OF PLUTONIUM. Karl S. Bergstresser. Feb. 13, 1950. Decl. Aug. 30, 1956. 38p. Contract W-7405-eng-36. $6.30(ph OTS); $3.00 (mf OTS).

Procedures for the analysis of plutonium binary alloys of cobalt, nickel, and copper were developed. They include colorimetric analysis of cobalt with nitroso-R salt and of nickel with dimethylglyoxime. Satisfactory gravimetric procedures have involved precipitation of copper with salicylaldoxime and as cuprous thiocyanate, and precipitation of nickel with dimethylglyoxime. One volumetric method, copper by iodometric titration, was also used. The recommended procedures were employed in the analysis of various plutonium alloys. (auth)

1112 LA-1064

Los Alamos Scientific Lab., N. Mex.

ELECTROANALYSIS OF COBALT, NICKEL, AND COPPER IN PLUTONIUM SOLUTIONS WITH A MERCURY CATHODE. Karl S. Bergstresser. Feb. 3, 1950. Decl. Aug. 30, 1956. 22p. Contract W-7405-eng-36. $4.80(ph OTS); $2.70(mf OTS).

Equipment and analytical procedure are described for the analysis of cobalt, nickel, or copper in the presence of plutonium by electrodeposition on a mercury cathode. Only submicrogram quantities of plutonium remain with the amalgam which is formed. The analyses of some binary plutonium alloys of these metals are reported. (auth)

1113 LA-1463(Del.)

Los Alamos Scientific Lab., N. Mex.

DETERMINATION OF ZIRCONIUM IN PLUTONIUM—ZIRCONIUM ALLOYS. K. S. Bergstresser. Sept. 5, 1952. Decl. with deletions Oct. 5, 1956. 22p. Contract W-7405-eng-36. $4.80(ph OTS); $2.70(mf OTS).

A method for determining zirconium in plutonium—zirconium alloys was required as part of an investigation of alloys containing fissionable material, with possible use in nuclear reactors. Alloys of these two elements were brought into solution with a bisulfate fusion and the zirconium was separated by precipitation with p-bromomandelic acid. Determinations were completed by weighing the zirconium oxide obtained after ignition of the precipitate at 925°C. The precision of this recommended procedure was estimated in terms of the standard deviation for quadruplicate determinations, made with weight aliquots from dissolved alloy samples. The range for the standard deviation was 0.5 to 1.7 parts per thousand for samples from which aliquots each containing 9 to 15 mg of zirconium were selected. The complete recovery of zirconium from solutions of pure zirconyl chloride and plutonium trichloride was shown by the 95% confidence limits of 99.9 ± 0.3% for the average of four determinations, observed with samples containing 5 to 12 mg of zirconium in the presence of 10 to 20 mg of plutonium: It was found that Mo, La, Pu(III), and $K_2Cr_2O_7$ do not interfere with zirconium determinations made according to the recommended procedure, but Pu(IV) does interfere slightly. It was also observed that small amounts of Pu(III) do not interfere with the colorimetric determination of zirconium by means of a zirconium-alizarin sulfonate lake. (auth)

1114 LA-1707
Los Alamos Scientific Lab., N. Mex.
EFFECT OF PLUTONIUM ON THE FLUOROMETRIC DETERMINATION OF URANIUM. Karl S. Bergstresser. July 1954. Decl. July 27, 1956. 23p. Contract W-7405-eng-36. $4.80(ph OTS); $2.70(mf OTS).

The fluorometric method for determining microgram quantities of uranium dissolved in concentrated sulfuric acid was reinvestigated for the purpose of measuring any interference caused by plutonium in uranium samples. No plutonium fluorescence, and therefore no positive errors due to plutonium, was observed. Limited transmittance of hexavalent plutonium in sulfuric acid at 513, and especially at 360 millimicrons, produces variable negative errors in uranium determinations. (auth)

1115 LAMS-1267
Los Alamos Scientific Lab., N. Mex.
DETERMINATION OF PARTICLE SIZE DISTRIBUTION AND SURFACE AREA BY PHOTOMETRY. D. R. King and J. B. Panowski. May 13, 1948. Decl. Nov. 5, 1958. 20p. Contract W-7405-eng-36. $4.80(ph OTS); $2.70 (mf OTS).

The photelometer was initially obtained to determine the particle distribution of subsieve barium nitrate and other materials. Heretofore these determinations were made using a "pipette-sedimentation" apparatus. This method was found inaccurate for barium nitrate samples having a large percentage of the particles less than 15 μ in diameter. This inaccuracy was attributed to the unsatisfactory dispersion obtained using the procedure as originally adopted. It was obvious from visual observation that barium nitrate agglomerates of considerable size (later under microscopic study found to be 20 to 100 μ) were not broken up in butyl alcohol even with vigorous and extended shaking. It was found that a better dispersion could be made by using a mixture of methyl and octyl alcohols as the dispersing medium. In utilizing the photelometer for procuring the most rapid and reliable determinations, it was deemed desirable to use a single component dispersing medium. Experiments with a Waring Blendor showed improved and reproducible dispersions could be obtained using a single component dispersing medium, and from visual observation it was apparent the agglomerates were broken up. A series of tests was made to determine the degree of comminution caused by such agitation. The results of these tests showed no detectable reduction of primary particles. (auth)

1116 LAMS-1698
Los Alamos Scientific Lab., N. Mex.
DETERMINATION OF HYDROGEN IN LITHIUM HYDRIDE. Karl S. Bergstresser and Glenn R. Waterbury. May 1954. Decl. Oct. 5, 1956. 39p. Contract W-7405-eng-36. $6.30(ph OTS); $3.00(mf OTS).

A method for determining hydrogen in lithium hydride by heating samples with lead at 600°C was developed. The hydrogen evolved during thermal decomposition of the hydride is purified and oxidized to water with cupric oxide at 400°C. The analysis is completed by collecting and weighing this water. Success in development of the analytical procedure has depended upon a careful design and assembly of equipment for handling samples in a dry, inert atmosphere. For seven pure hydride samples analyzed by the recommended method the estimates of the standard deviation varied between 0.12 and 0.41% lithium hydride (or 1.3 and 4.2 parts per thousand) for 8 to 18 determinations on each sample. The procedure is relatively insensitive to variations in certain conditions. For single-piece samples weighing 0.2 to 0.5 gram it was found to be more satisfactory than a method which uses mercury in place of lead for sample decomposition. For powdered lithium hydride samples the lead and mercury methods are equally satisfactory. (auth)

1117 MLM-1070
Mound Lab., Miamisburg, Ohio.
THE QUANTITATIVE DETERMINATION OF URANIUM AND BERYLLIUM IN FUSED-SALT SYSTEMS. N. E. Rogers and W. D. Prather. Apr. 3, 1956. Decl. July 11, 1957. 15p. Contract AT-33-1-GEN-53. $3.30 (ph OTS); $2.40(mf OTS).

A method is described for the quantitative separation and determination of uranium and beryllium in the presence of macro quantities of sodium in a ternary system of fused fluorides. The fluoride ion is volatilized as fluoboric acid during the dissolution of the dried mixed-salts with acids. The separation of uranium from beryllium and sodium is accomplished by the electrolytic deposition of the uranium as a hydrous oxide on a platinum electrode from a hot ammonium acetate solution at a pH of 4.0. The beryllium remains in the plating solution with the sodium, and is determined as the hydroxide. Both the uranium deposit and the beryllium hydroxide precipitate are ignited and weighed as their respective oxides. Sodium is determined by means of the flame photometer, or it may be calculated as the difference between the combined weights of the uranium and beryllium fluorides and the original sample weight. (auth)

1118 NP-6987
Brussels. Centre D'Étude de l'Énergie Nucléaire.
TOESTEL VOOR HET GROEIEN VAN ZEER ZUIVERE EENKRISTALLEN VAN REFRAKTAIRE METALEN DOOR ELEKTRONENBESCHIETING. (Apparatus for the Growth of Very Pure Single Crystals of Refractory Metals by Electron Bombardment). A. Van den Bosch and R. De Coninck. June 23, 1958. 11p.

An apparatus which is used for the production of single crystals of refractory metals is described in detail. The refractory metal is placed in a vacuum chamber and zone melted by electron bombardment. The impurities are removed by evaporation during the zone melting. In the cooling part of the zone, with a strong temperature gradient, the single crystals grow. The vacuum production and the mechanical parts of the apparatus are described in detail. A schematic is given of the electrical part. The procedure used is given. (J.S.R.)

1119 NYO-2370
Pittsburgh. Univ.
A THERMODYNAMIC STUDY OF SOME FACTORS AFFECTING THE STABILITY AND SOLUBILITY OF METAL CHELATES. (thesis). David Fleischer. [1958]. 153p. Contract AT(30-1)-860. \$24.30(ph OTS); \$7.50 (mf OTS).

Studies are presented on the formation and solubility of metal chelates. The reactions of 8-quinolinol and its homologs, 2-methyl- and 4-methyl-8-quinolinol, with bivalent ions of Cu, Ni, and cobalt were examined. Attention is focused on methods for the direct determination of heats of reaction. For the solubility work the compounds copper(II) and nickel(II) dimethylglyoxime were examined. Attention is directed towards separating the effects of crystal energy and solvation energy on the solubility. (W.L.H.)

1120 ORNL-2460
Oak Ridge National Lab., Tenn.
HYDROFLUORIC ACID DECLADDING OF ZIRCONIUM-CLAD POWER REACTOR FUEL ELEMENTS. W. E. Clark and A. H. Kibbey. Nov. 7, 1958. 17p. Contract W-7405-Eng-26. \$0.75(OTS).

A detailed flowsheet is presented for the removal of Zircaloy-2 cladding from a UO_2 core (as in the Commonwealth Edison fuel) by dissolution in hydrofluoric acid to give a F/Zr ratio of 4.5/1 in the solution. The core is dissolved in 8 M HNO_3 for subsequent removal of fission products by solvent extraction. In tests on unirradiated prototypes, uranium loss to the fluoride solution was as little as 0.16%. Dissolution data on uranium metal and U-10% Mo alloy indicate that these cores can be declad similarly. U–Zr alloys cannot be so stripped while U–Nb is somewhat doubtful. It appears that pure zirconium cladding can be removed about as easily as Zircaloy-2. One container constructed of Carpenter 20 (niobium stabilized) stainless steel can probably be used for both dissolution steps. (auth)

1121 ORNL-2577
Oak Ridge National Lab., Tenn.
LOOP STUDIES ON THE BEHAVIOR OF PREFORMED ZrO_2 IN URANYL SULFATE SOLUTION. R. W. Horton, J. R. Bowen, and P. A. Haas. Nov. 6, 1958. 19p. Contract W-7405-eng-26. \$0.75(OTS).

Results reported for the behavior of preformed ZrO_2 in 0.04 m UO_2SO_4 solution circulated in three pumped loops showed deposition on surfaces dependent on loop geometry, flow conditions, surface conditions, and other parameters. Because of the great importance of geometry effects, the results do not permit prediction of the behavior of ZrO_2 in the HRT. (auth)

1122 ORNL-2584
Oak Ridge National Lab., Tenn.
CHEMISTRY DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING JUNE 20, 1958. 131p. Contract W-7405-eng-26. \$2.75(OTS).

Nuclear Chemistry. The γ-ray spectrum of 16-sec Tc^{100} was determined. Fast neutrons were used to produce a (7.8 ± 0.2)-min activity by means of the reaction $Ge^{74}(n,p)\ Ga^{74}$. Both 86-sec I^{136} and 2.9-min Rb^{90} decay with emission of energetic beta and gamma radiations. A level scheme for Zr^{90} was formulated by studies on the decay of 14.6-hr Nb^{90}. The polarization of electrons emitted in the beta decay of P^{32} is being measured. A spectrophotometric examination of several compounds or oxidation states of Tc and Re in solution was made. Some details are given of the procedure used for the isolation of an additional amount, 115g, of Np^{237}. Fractionation of Li isotopes between aqueous Li ions and Li ions on various ion exchange resins was observed to vary as a function of resin type, resin cross-linkage, and the nature of the complexing agent in the aqueous phase. Studies dealing with the chemical separation of B isotopes were continued. Infrared spectra of isotopic species of N_2O, NOCl, and BF_3 were observed. Radiation Chemistry. The yield of molecular hydrogen in the radiolysis of water was found to be independent of pH and added Na_2SO_4. Radiation induces reaction between Fe^{3+} and Sn^{2+}, and between Ce^{6+} and As^{3+}. Studies of the kinetics of radiation induced reduction of Ce^{4+} in solutions are presented. The alpha-particle radiolysis of CO produced CO_2 and solid products which are mainly $(C_3O_2)_x$ and C. The effect of ionizing radiation upon heterogeneous catalysts was investigated. Organic Chemistry. Further evidence was obtained for the mechanism of the rearrangement of phenyl-di-p-tolylacetaldehyde in the presence of cold concentrated H_2SO_4. The stereochemistry of the deamination of (+)-1,2,2-triphenylethyl-1-C^{14}-amine at 25°C was studied. The optical configurations of (+)-1,2,2-triphenylethylamine and (+)-1,2,2-triphenylethanol have been related. The dispersion of ThO_2 in nonpolar solvents was studied. Relatively inert esters of sulfur and phosphorus acids were converted to salts of compounds such as ethanolamine. The distribution of univalent electrolytes between TBP and aqueous phase was measured as a function of the electrolyte type and concentration. Chemistry of Aqueous Systems. The equilibrium and rate behavior of several new organic ion exchangers was examined. Survey investigations with four types of liquid ion exchangers were completed. Calorimetric measurements of the differential heats of ion exchange of Na^+ ion with H^+, Li^+, K^+, and Cs^+ ions in a series of six differently cross-linked polystyrene sulfonate-type cation exchangers, and of Br^- ion with F^-, Cl^-, and I^- ions in a series of five differently cross-linked polystyrene quaternary-ammonium-type anion exchangers were performed at 25°C as a function of the resin loading. A rotor which allows simultaneous ultracentrifugation of five solutions was tested and found satisfactory. The performance and general reliability of the first high-temperature spectrophotometric cell are described. The pH values of UO_2SO_4 solutions were measured in the range 25 to 180°C with a high-temperature pH meter. Temperatures for the transition from a homogeneous to a two-liquid system were determined for the system $UO_2SO_4-CuSO_4-H_2SO_4-H_2O$ at elevated temperature. Phase equilibrium data from the system $NiO-SO_3-H_2O$ were obtained from 150 to 300°C and from 1 to 10^{-4} m SO_3. The measurement of vapor pressures of aqueous systems at elevated-temperature was resumed. The decomposition of peroxide in UO_2SO_4 solutions was found to proceed 13% faster in heavy-water solutions than in light-water solutions. A method of measuring pH of ThO_2 slurries was developed. The study of the temperature dependence of ion exchange equilibria in pressurized systems up to 200°C was continued. Chemistry of Corrosion. It was demonstrated that a deaerated pertechnetate solution does not convert ferrous ions to a precipitated oxide under conditions which permit inhibition of corrosion. With the use of the galvanostatic and potentiostatic procedures the kinetics of the reduction of uranyl ions at a passive stainless steel electrode in H_2SO_4 were investigated. In the continued study of isotopic fluorine exchange between gaseous fluorocarbons and solid inorganic fluorides, the exchange between radioactive perfluoropropene and specially prepared alkali fluoride crystals was measured. The liquid-liquid phase equilibria of the systems Li—LiF and Rb—RbF were found to fit the series of the alkali metal-fluoride systems in the expected regular manner. Measurements of the electrical conductivity of Na and K metal solutions in their molten iodides confirmed the previously observed connection with the degree of ideality of the solution, or the degree of association of the metal, possibly to Na_2 and K_2 molecules. Measurements in molten KNO_3 of the activities of $AgNO_3$ in the presence of Cl^- ions and of the solubility of $AgNO_3$ were successfully interpreted in terms of the preferential distribution of Cl^- ions about the Ag^+ ions. The solubility of noble gases in molten fluoride mixtures was found to increase with gas pressure, temperature, and decreasing atomic number of the noble gas. The solubility of some fission product fluorides in molten fluoride mixtures was determined. Chemical Physics. Atomic hydrogen assays by the paramagnetic resonance method were made on frozen solutions of sulfuric, phosphoric, and perchloric acids at 77°K after irradiation. The results of the completed single-crystal neutron diffraction study of H_2O_2 are given in detail. The dissociation of C_6H_5T into 31 singly charged fragments following beta decay was studied. (For preceding period see ORNL-2386.) (W.L.H.)

1123 ORNL-2627
Oak Ridge National Lab., Tenn.
THE USE OF TRI-n-OCTYLPHOSPHINE OXIDE IN THE SOLVENT EXTRACTION OF THORIUM FROM ACIDIC SOLUTIONS. W. J. Ross and J. C. White. Nov. 20, 1958. 33p. Contract W-7405-eng-26. $1.00(OTS).

Thorium is readily extracted by a solution of tri-n-octylphosphine oxide in cyclohexane from either acidic nitrate or chloride solutions. The maximum extraction coefficient in a nitrate medium is 380 as compared to 1300 for a chloride solution. In nitrate media the extraction coefficient is relatively unaffected by changes in the anion concentration. In chloride media the coefficient varies directly with increasing chloride concentration, i.e., from about 0.4 in one molar chloride to the maximum in 7 to 10 molar. The acid concentration should be at least one molar. Thorium is not appreciably extracted from sulfate solutions. The extraction coefficient is of the order of 0.3. The addition of nitrate or chloride increases the coefficient sufficiently so that essentially 99% of the thorium can be extracted in a single equilibration. In perchlorate systems the extraction is most efficient in one molar acid. The maximum coefficient is about 80. The amount of thorium that can be extracted to 99% in a single 10-minute equilibration period is 46 mg in nitrate and 28 mg in chloride systems per millimole of TOPO. The extracted species are postulated to be $ThCl_4 \cdot HCl \cdot 3[n\text{-}(C_8H_{17})_3PO]$ and $Th(NO_3)_4 \cdot HNO_3 \cdot 3[n\text{-}(C_8H_{17}]_3PO)$ wherein the concentration of the acid adduct is a function of the initial concentration of acid in the aqueous phase. (auth)

1124 WAPD-CTA(GLA)-154(Rev.1)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE DETERMINATION OF COPPER AS AN IMPURITY IN ZIRCONIUM AND ZIRCALOY. G. W. Goward and B. B. Wilson. Apr. 16, 1957. 6p. $1.80(ph OTS); $1.80(mf OTS).

Copper forms a colored complex with neo-cuproine (2, 9-dimethyl-1, 10-phenanthroline) in a chloroform—ethyl alcohol system with a maximum absorbance at 457 mu. The method covers the determination of impurity copper in zirconium and Zircaloy in the range of 25 to 3000 ppm on a one gram sample basis. (auth)

1125 WAPD-CTA(GLA)-155(Rev. 1)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE DETERMINATION OF LEAD AS AN IMPURITY IN ZIRCONIUM AND ZIRCALOY. G. W. Goward and B. B. Wilson. Apr. 23, 1957. 6p. $1.80(ph OTS); $1.80 (mf OTS).

The sample is brought into a solution having a definite volume and acidity. Citrate and cyanide are added, the solution is adjusted to pH 9.0 to 9.5, and lead is extracted with dithizone in chloroform. Separation from interfering elements is accomplished by extraction of the lead back to a buffered aqueous phase and subsequent re-extraction with chloroform-dithizone from ammonium cyanide medium. The method covers the determination of impurity lead in zirconium metal and Zircaloy in the range of 50 to 500 ppm on a one gram sample basis. (auth)

1126 WAPD-CTA(GLA)-182(Rev. 1)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh
and Westinghouse Electric Corp. Research Labs., East Pittsburgh, Penna.
THE DETERMINATION OF MANGANESE AS AN IMPURITY IN ZIRCONIUM AND ZIRCALOY. E. W. Beiter, R. M. Burd, and G. W. Goward. Mar. 17, 1957. 4p. $1.80(ph OTS); $1.80(mf OTS).

In sulfuric acid solution, manganous ion is quantitatively oxidized to permanganate ion by alkali periodates. The permanganate color, which is stable in the presence of excess periodate, exhibits an absorbance maximum at 525 mu. The interference of residual or alloying iron, chromium, and nickel is eliminated by discharging the permanganate color in a portion of the sample solution with sodium azide and using this solution as a blank. The method covers the determination of manganese as an impurity in zirconium and Zircaloy in the range of 10 to 200 ppm on the basis of a one gram sample. (auth)

1127 WAPD-CTA(GLA)-193(Rev. 1)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
THE DETERMINATION OF CHLORIDE AS AN IMPURITY IN ARC MELTED ZIRCONIUM AND ZIRCALOY. CHLORIDE IN ARC-MELTED METAL AND ALLOY. G. W. Goward, A. W. Perrine, J. F. Rodgers, and H. R. Wilson. Apr. 18, 1957. 4p. $1.80(ph OTS); $1.80(mf OTS).

Chloride is precipitated as a suspension of silver chloride by the addition of silver nitrate to an acid solution of the sample. The concentration of chloride is determined by nephelometric measurement of this suspension. The method covers the determination of 5 to 100 ppm of chlorine on a one gram sample of zirconium or Zircaloy. (auth)

1128 WAPD-CTA(GLA)-326
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
TENTATIVE METHOD FOR THE DETERMINATION OF COBALT AS AN IMPURITY IN ZIRCONIUM AND ZIRCALOY. P. Tate, N. R. Wilson, G. W. Goward, and

E. W. Beiter. Jan. 28, 1957. 5p. $1.80(ph OTS); $1.80(mf OTS).

Cobalt in buffered hydrofluoric acid solution is extracted with chloroform as the nitroso-naphtholate complex. The extract is evaporated to dryness, the organic material destroyed, and the cobalt reacted with nitroso-R salt in a hot acetate buffered solution to give a soluble red complex salt. Hydrochloric acid is then added to decompose nitroso-R complexes of other heavy metals. Cobalt is then determined by spectrophotometric measurement at 510 mu. The method is applicable to the determination of cobalt in zirconium and Zircaloy in the concentration range of 0.5 to 30 ppm on a one gram sample basis. (auth)

1129 AEC-tr-3050

THERMODYNAMICS OF REACTIONS OF HYDROCARBONS. A. V. Frost. Translated for Atomics International from Khim. Tverdogo Topliva 4, 171-85 (1933). 28p.

The relations between the concentrations of the reacting substances at the moment of equilibrium for a series of hydrocarbon reactions were investigated. The conclusions and calculations based on experimental data in these reactions are presented, including hydrogenation of ethylene and benzene hydrocarbons and condensation of benzene to diphenyl. In addition, a study of the conditions of carbon precipitation in relation to thermal decomposition of hydrocarbon mixtures was conducted. (J.R.D.)

1130 AEC-tr-3341

DETERMINATION OF SCANDIUM WITH QUINALIZARIN AND THE SIMILARITY OF SCANDIUM PYROPHOSPHATE TO SCANDIUM PHYTATE. G. Beck. Translated by Maynard A. Hiller (Ames Lab.) from Mikrochemie ver Mikrochim. Acta 34, 282-5 (1949). 7p.

Determination of Sc using quinalizarin is described. Methods of distinguishing the color in the organic phase from other elements are described, and the reduction of interfering iron (III) to iron (II) is discussed. The blue solution of the Sc quinalizarinate in isoamyl alcohol can be determined colorimetrically by use of a S57 or S61 filter or it can be titrated colorimetrically as Fischer proposed for Be. In addition, the determination of Sc as the basic salt scandium phytate structure with scandium pyrophosphate is given. (J.R.D.)

1131 AEC-tr-3403

POLAROGRAPHIC INVESTIGATION OF NIOBIUM COMPOUNDS. A. G. Stromberg and L. M. Reinus. Translated by Oak Ridge National Lab. Library Staff from Trudy Komissi Anal. Khim. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk 2, 35-53(1949). 22p.

Niobium pentoxide was used as starting material in the investigation. The results indicate the possibility of quantitative polarographic determination of niobium in nitric acid solutions. The polarographic niobium wave was obtained only in acid nitrate solutions, the hypothesis being that the niobium appears as a niobyl complex with nitric acid. A description of apparatus used, preparation of reagents, and experimental techniques are included. (J.R.D.)

1132 AEC-tr-3448

NITRIC ACID OXIDATION KINETICS. I. E. Abel. Translated by K. S. Bevis (Savannah River Lab.) from Monatsh. Chem. 89, 74-8(1958). 6p.

The kinetics of oxidation by nitric acid is developed. It is pointed out that in the nitric acid oxidation system there are three differential equations which represent the temporary reaction patterns in reduction to nitric oxide. (J.R.D.)

1133 JPRS-617

SULFUR METHOD FOR DETERMINING OXYGEN (OXIDES). PART 2. DETERMINATION OF MICRO-AMOUNTS OF OXYGEN IN COPPER, NICKEL, CHROMIUM AND MOLYBDENUM. A. K. Babko, A. I. Volkova, and O. F. Drako. Translated from Zavodskaya Lab. 23, 136-40(1957). 9p.

Available from Photoduplication Service, Library of Congress.

For Part 1 see Zavodskaya Lab. 22, No. 6 (1956).

The method is based on the combustion of metal in sulfur vapors, in the course of which the metal is converted into a sulfide while the oxygen forms sulfur anhydride, which is determined later colorimetrically with the aid of fuchsin-formaldehyde reaction. The sensitivity of this reaction is sufficiently high. The method is suited for metals whose sulfides are more stable than their oxides. However, a control test has shown that products are uncovered in the absorption phial which produce coloration with fuchsin-formaldehyde reagent and decolorize 1 to 2 drops of an 0.01N iodine solution. On the basis of experiments conducted on the sublimation of sulfur in a nitrogen atmosphere, it is concluded that traces of nitrogen sulfide are formed in the process. They are dissolved by water in the absorption phial, with partial formation of sulfurous anhydride and ammonia. Substitution of argon for nitrogen failed to produce any noticeable effect, which is probably attributable to the difficulties of complete purification of argon from nitrogen. Therefore, it became necessary to treat metal with sulfur vapors in a vacuum, which was created with the aid of the usual rough-vacuum pump. After the treatment had been completed and the tube cooled, the gaseous products of reaction were "washed out" of the tube with pure nitrogen, absorbed by water, and then identified. (auth)

1134 SCL-T-203

APPLICATION OF NUCLEAR MAGNETIC RESONANCE TO THE STUDY OF THE POLYMERIZATION PROCESS. (Application de la Résonance Nucléaire à l'étude du Processus de Polymérisation). A. Losche. Translated by Marcel I. Weinreich (Sandia Corp.) from Arch. sci. (Geneva) 10, 197-9(1957). 4p.

An epoxy resin was used in the study of the polymerization process by observing the form of the absorption signals of the proton in the paramagnetic nuclear resonance. (W.L.H.)

1135

SEPARATION OF ISOMERIC POLYPHENYLS BY ADSORPTION CHROMATOGRAPHY. Max Hellman, Roy L. Alexander, Jr., and Charles F. Coyle (National Bureau of Standards, Washington). Anal. Chem. 30, 1206-10 (1958) July.

The chromatographic behavior of selected polyphenyls was studied to develop a method for separating mixtures of these compounds. A variety of adsorbents such as alumina, fuller's earth, silica gel, and different grades of charcoal were used. The separations of known mixtures were studied by the elution technique and elution curves were drawn. Results obtained with several adsorbent-eluent systems are compared. Some separation occurred in most cases, with the alumina-iso-octane combination providing maximum over-all effectiveness.

in separation and recovery. Some charcoals give better separation but material recovery is poor. On the basis of the results obtained, the behavior of mixtures of higher polyphenyls is predicted. (auth)

1136

POLAROGRAPHY OF METAL IONS IN FUSED LITHIUM CHLORIDE-POTASSIUM CHLORIDE EUTECTIC. H. A. Laitinen, C. H. Liu, and W. S. Ferguson (Univ. of Illinois, Urbana). Anal. Chem. 30, 1266-70(1958) July.

The feasibility of using voltammetric techniques for the direct determination of metal ions in fused lithium chloride-potassium chloride at 450° has been investigated. Using a reference electrode of platinum, and microelectrodes of platinum, tungsten, or carbon, the polargraphic characteristics of cadmium, bismuth, chromium, copper, zinc, thallium, indium, lead, tin, gallium, mercury, and aluminum chlorides were studied. In general, high melting metals gave dendritic deposits which caused an increase of microelectrode area with time. Under suitable conditions voltammetric measurements can be used for analytical purposes. (auth)

1137

MICRODETERMINATION OF DEUTERIUM BY EFFUSIOMETRY. D. A. Lee (Oak Ridge National Lab., Tenn.). Anal. Chem. 30, 1296-8(1958) July.

To facilitate hydrogen—deuterium exchange reaction studies, a simple and rapid method was developed for determining deuterium in various compounds. The compounds containing deuterium were converted into hydrogen—deuterium gas by reacting them with uranium metal turnings at 500°C. The rate of effusion of the gas through an orifice was measured using a matched pair of thermistors as a pressure gage. Deuterium was determined to ±1%; a few hundredths of 1 cc of gas at standard conditions was sufficient to make a determination. (auth)

1138

SPECTROCHEMICAL METHOD FOR THE DETERMINATION OF SELENIUM. Claude L. Waring, Helen W. Worthing, and Katherine V. Hazel (U. S. Geological Survey, Washington). Anal. Chem. 30, 1504-6(1958) Sept.

Selenium can be determined by pyrite, chalcocite, and marcasite by a simple and rapid spectrochemical method that requires no complicated arrangement of spectrographic equipment or chemical pretreatment of samples. Advantage is taken of the new short wavelength radiation plates (Eastman) and the addition of copper oxide to enhance the selenium lines 2039.85 and 2062.78 A. The possibility exists of determining many other elements on the same exposure of the sample. The method is applicable in the range of 0.0015 to 2% selenium. Tests indicate an average difference from the chemical results of 0.07% in the few per cent range, 0.03% in the 0.1 to 1.0% range, 0.005% in the 0.01 to 0.1% range, and 0.00075% in the 0.001 to 0.01% range. The relative accuracy over the entire range is to about 7% of the concentration. (auth)

1139

COPRECIPITATION IN SOME BINARY SYSTEMS OF RARE EARTH OXALATES. A. M. Feibush, Keith Rowley, and Louis Gordon (Brookhaven National Lab., Upton, N. Y. and Syracuse Univ., N. Y.). Anal. Chem. 30, 1605-9(1958) Oct.

On the basis of an equilibrium model, the distribution coefficient, λ, in the Doerner-Hoskins equation should be functionally related to the solubility products of the coprecipitating species. In the case of the rare earth oxalates, the coefficient should be equal to the square root of the ratio of the solubility products. The neodymium-cerium, yttrium-cerium, and ytterbium-neodymium systems were studied. These systems obeyed the Doerner-Hoskins relationship in that the distribution coefficient, λ, was constant over the range 0 to 100% of the host crystal precipitated; when the mole ratio composition of the solid phase of the neodymium-cerium system was varied over a 10^6 range, λ also remained constant. However, the equilibrium model does not appear to be valid because there is no correlation between λ and the solubility product ratio. It appears likely that the value of the distribution coefficient is determined by the kinetics of the precipitation process rather than the solubilities of the substances. (auth)

1140

SOLUBILITY OF YTTRIUM OXALATE. A. M. Feibush, Keith Rowley, and Louis Gordon (Brookhaven National Lab., Upton, N. Y. and Syracuse Univ., N. Y.). Anal. Chem. 30, 1610-12(1958) Oct.

The solubility product of yttrium oxalate and the dissociation constants of the yttrium oxalate complexes have been measured by the method developed by Crouthamel and Martin. The solubility product was determined to be 5.34×10^{-29}. The complex ions detected were: $Y(C_2O_4)^+$, $K_1 \cong 3 \times 10^{-7}$; $Y(C_2O_4)_2^-$, $K_2 \cong 8 \times 10^{-11}$; and $Y(C_2O_4)_3^{---}$, $K_3 \cong 3.4 \times 10^{-12}$. (auth)

1141

VOLUMETRIC DETERMINATION OF THORIUM IN URANIUM ALLOYS. Hobart H. Willard, Arthur W. Mosen, and Ross D. Gardner (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 30, 1614-16(1958) Oct.

Thorium is determined in uranium—thorium, uranium—tungsten—thorium, and uranium—titanium—thorium alloys by precipitation as the fluoride, using lanthanum as a carrier, followed by titration with EDTA. Eriochrome Cyanine RC is used as the indicator in the titration. In 161 determinations of known solutions simulating the alloys with a thorium content of 0.1 to 3.0%, an average of 99.4% of the thorium was found. The relative standard deviation for individual values was 0.56% with no significant difference in the various synthetic solutions. (auth)

1142

DETERMINATION OF LITHIUM AND SODIUM CHLORIDES BY POTENTIOMETRIC TITRATION FOLLOWING 2-ETHYL-1-HEXANOL SEPARATION. Glenn R. Waterbury, Edward H. Van Kooten, and Bruno Morosin (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 30, 1627-9(1958) Oct.

Sodium and lithium chlorides are titrated potentiometrically with silver nitrate following two extractions of the lithium chloride with 2-ethyl-1-hexanol. Using glass and silver—silver chloride electrodes, the detection of the end point is enhanced in the organic medium. For 17 determinations, an average of 99.99% was obtained for lithium, with a standard deviation of 0.16%, and an average of 99.9% for sodium, with a standard deviation of 0.4%. A study of the effect of 20 other metals on the analysis showed that lithium is also separated by the extraction from aluminum, barium, and tungsten; sodium may be determined in the presence of lithium and plutonium, cadmium, cobalt, iron, magnesium, neodymium, nickel, tin, uranium, or zinc. (auth)

1143

SPECTROPHOTOMETRIC DETERMINATION OF LANTHANUM IN PLUTONIUM. Karl S. Bergstresser (Los Alamos Scientific Lab., N. Mex.). Anal. Chem. 30, 1630-2(1958) Oct.

Lanthanum in plutonium samples can be determined by formation of plutonium(VI) in a perchloric acid solution of the sample and precipitation of lanthanum with hydrofluoric acid. The fluoride precipitate is dissolved in fuming perchloric acid, and lanthanum is reprecipitated with 8-quinolinol. The lanthanum oxinate is dissolved in 0.1N hydrochloric acid to obtain a solution which is suitable for photometric measurements at 365 mμ. The standard deviation for a single measurement is equivalent to 3 γ for a range of 40 to 200 γ of lanthanum. (auth)

1144

CATHODIC ELECTRODEPOSITION METHODS FOR COBALT. Darnell Salyer and Thomas R. Sweet (Ohio State Univ., Columbus). Anal. Chem. 30, 1632-5(1958) Oct.

Radiotracer techniques and cobalt-60 were used to study methods for the determination of cobalt by cathodic electrodeposition. The quantity of cobalt left in the electrolytic solution was determined after electrodeposition by 10 of the most frequently used procedures for cobalt. Some cobalt remained in solution in every case. The amount varied from 0.01 to 4.0 mg, with an average of 0.46 mg. of cobalt for 43 determinations. For the most part the cobalt left in solution is the result of the washing of the deposits and is not simply metal that was never deposited. A special washing procedure whereby the electrolytic solution was gradually replaced by distilled water until the current dropped to zero did not decrease the cobalt left in solution. The average positive error for 43 single determinations of cobalt was 0.74 mg before, and 1.19 mg after correcting for the cobalt left in solution. Correcting the data for the residual cobalt increased the errors. (auth)

1145

VOLTAMMETRIC STUDIES WITH THE GRAPHITE INDICATING ELECTRODE. Philip J. Elving and Alan F. Krivis (Univ. of Michigan, Ann Arbor). Anal. Chem. 30, 1645-8(1958) Oct.

In preparation for use of the graphite electrode in chronopotentiometry, automatically recorded current-potential curves obtained with it were further evaluated by studying a variety of inorganic and organic reversible and irreversible systems. In mineral acid solutions penetration of the solution into wax-impregnated graphite resulted in poor reproducibility. Satisfactory results are obtained in slightly acidic and neutral media; alkaline media were not investigated. Experimental conditions must be carefully controlled for good results. The reductions of silver(I) and mercury(II) are comparable to those obtained with the platinum electrode; iron(III) gave poor results. Results with the quinone–hydroquinone system were good, except that $E_{1/2}$ for the oxidation and reduction processes did not coincide. Oxidation studies of the three isomeric phenylenediamines and the three isomeric dihydroxybenzenes at pH 5.5 were satisfactory. The o- and p-phenylenediamines undergo 2e oxidation, the latter showing semiquinone formation; the meta shows a 1e wave due apparently to the formation of a free radical which polymerizes. Hydroquinone and catechol show the same 2e oxidation; the meta isomer, resorcinol, apparently oxidizes to a free radical which polymerizes to a film that coats the electrode. (auth)

1146

ANODIC CHRONOPOTENTIOMETRY WITH A GRAPHITE ELECTRODE. ANALYTICAL APPLICATIONS. Philip J. Elving and Alan F. Krivis (Univ. of Michigan, Ann Arbor). Anal. Chem. 30, 1648-52(1958) Oct.

Electrolysis at constant current (chronopotentiometry) using a graphite indicating electrode was investigated. Poor results were obtained with inorganic reductions; much better results with organic oxidations. Electrolysis of the three dihydroxybenzene isomers at pH 5.5 results in oxidation of hydroquinone and catechol to p- and o-benzoquinone, respectively, and in destructive oxidation or postelectrolytic polymerization in the case of resorcinol. Binary and ternary mixtures of the dihydroxybenzene isomers can be analyzed quantitatively; if both hydroquinone and catechol are present, the concentration of one has to be determined separately. Anodic chronopotentiometry of the three isomeric phenylenediamines indicates the differing nature of the mechanisms involved. At pH 2, 5, and 11, o- and p-phenylenediamine undergo a 2e oxidation, presumably to the diimine; at pH 5.5 the ortho isomer undergoes a subsequent 1e process. The latter may be due to reaction of the diimine with o-phenylenediamine to produce diaminophenazine, which is oxidized by a 1e step to a free radical which then polymerizes. The meta isomer seems to undergo at pH 5.5 a 3e oxidation to a final polymeric product and at pH 11.2 a 2e oxidation which leads either to an insoluble polymer or to destruction of the compound. (auth)

1147

SPECTROPHOTOMETRIC DETERMINATION OF THORIUM WITH 2-(4-CARBOXY-3-HYDROXYPHENYLAZO)-1,8-DIHYDROXYNAPHTHALENE-3,6-DISULFONIC ACID. Sachindra Kumar Datta (Darjeeling Government Coll., India). Anal. Chem. 30, 1653-6 (1958) Oct.

An azo dye, prepared from diazotized p-aminosalicylic acid and disodium salt of chromotropic acid, produces a reddish violet, soluble thorium complex. The color reaction exhibits an absorbance maximum at a wave length of 580 mμ and conforms to Beer's law. The thorium-dye complex appears to have the composition 1 to 1. A direct spectrophotometric method has been developed for the determination of thorium in dilute solutions. Only iron, zirconium, cerium(IV), gold, phosphates, and fluorides intefere. The interference of iron(III) can be removed by adding ascorbic acid. Thorium has also been estimated in monazite and black sands extracts with this dye. (auth)

1148

DISODIUM ETHYL Bis(5-TETRAZOLYLAZO)ACETATE TRIHYDRATE COLORIMETRIC REAGENT FOR NICKEL AND COPPER. Hans B. Jonassen, Virginia C. Chamblin, and Vernon L. Wagner, Jr. (Tulane Univ., New Orleans) and Ronald A. Henry (U. S. Naval Ordnance Test Station, China Lake, Calif.). Anal. Chem. 30, 1660-3(1958) Oct.

Disodium ethyl bis(5-tetrazolylazo)-acetate trihydrate forms a water-soluble, highly colored complex with nickel(II) ion that can be used for a quantitative colorimetric determination in the presence of cobalt and iron. It also forms a stable, highly colored, 1 to 1 complex with the copper(II) ion, which has a high absorbance value even at low concentration. Of the common cations of the first transition metal series, only cobalt(II) interferes; however, this can be eliminated by calculations using simultaneous equations. (auth)

1149

SYSTEM FOR COUNTING TRITIUM AS WATER VAPOR. W. F. Merritt (Atomic Energy of Canada, Ltd., Chalk River, Ont., Can.). Anal. Chem. 30, 1745-7(1958) Nov.

A method is described in which tritium is counted as water vapor in a heated proportional counter filled with methane. Introduction of the sample is rapid and simple, and convection mixing with the counting gas is obtained from the heating system. Good plateaus are obtained with small partial pressures of water vapor at 90°C. The counter is calibrated using a standard tritiated water sample. The system is simple and rugged and gives results reproducible within ±2% standard deviation. (auth)

1150

DETERMINATION OF AMERICIUM IN PLUTONIUM BY GAMMA COUNTING. Joseph Bubernak, Marion S. Lew, and George M. Matlack (Los Alamos Scientific Lab., New Mex.). Anal. Chem. 30, 1759-62(1958) Nov.

The gamma specific activity of americium-241, a common impurity in reactor plutonium, is 30,000 times greater than that of plutonium, when gamma rays above 30 kev are counted. This is the basis of a procedure for determining as little as 5 ppm of americium in plutonium. When counted in a well-type scintillation detector, americium-241 shows a specific activity of 2.2×10^6 cpm per γ, while that of plutonium-239 is only 75 cpm per γ. The average error is 2% standard deviation for 5×10^{-4} γ of americium or greater in the presence of up to 10 γ of plutonium. (auth)

1151

AUTOMATIC SPECTROPHOTOMETRIC TITRATION OF FLUORIDE, SULFATE, URANIUM, AND THORIUM. Oscar Menis, D. L. Manning, and R. G. Ball (Oak Ridge National Lab., Tenn.). Anal. Chem. 30, 1772-6 (1958) Nov.

An automatic, spectrophotometric titration method was applied to the measurement of microgram quantities of fluoride, sulfate, uranium, and thorium. A new indicator, quercetin, was utilized in the estimation of thorium by a titration with (ethylenedinitrilo)tetraacetic acid. Optimum conditions were established for the determination of as little as 6 γ of fluoride and sulfate, 12 γ of uranium, and 2 γ of thorium, with a coefficient of variation of 4, 5, 3, and 1%, respectively. In the case of sulfate, an approximately 10-fold increase in sensitivity was obtained by carrying out the titration in 50% isoamyl alcohol. The additions to a Warren Spectracord, which was used in this study, included the time-drive attachment, a titrant-feed assembly, and modifications to permit access to the sample compartment without removing the stirrer and buret tip. (auth)

1152

SPECTROPHOTOMETRIC DETERMINATION OF RARE EARTHS. James S. Fritz, Marlene Johnson Richard, and William J. Lane (Iowa State Coll., Ames). Anal. Chem. 30, 1776-9(1958) Nov.

Arsenazo[3-(2-arsonophenylazo)-4,5-dihydroxy-2,7-naphthalenedisulfonic acid] is used for the quantitative colorimetric determination of yttrium and rare earths. The method is applicable to the determination of very low concentrations of rare earth and is not highly pH dependent. Through the use of quick separations, good selectivity is achieved. Iron and other reducible metals are removed by electrolysis using a mercury cathode; aluminum interference is avoided by masking with sulfosalicylate, small amounts of uranium are removed by extraction as the diethyldithiocarbamate. Calcium and magnesium interference are avoided by pH control. (auth)

1153

NEUTRON ACTIVATION ANALYSIS OF ALUMINUM-BASE ALLOYS. William A. Brooksbank, Jr., and George W. Leddicotte (Oak Ridge National Lab., Tenn.). Anal. Chem. 30, 1785-88(1958) Nov.

Neutron activation analysis has been applied to the determination of copper, manganese, nickel, iron, zinc, and titanium in National Bureau of Standards aluminum alloys. The accuracy and precision of these analyses have been ascertained by the statistical treatment of the data. No bias was found for manganese, iron, and titanium methods. A positive bias was found for samples with high copper content, and a negative bias was detected for two samples in the zinc determination. The accuracy of the method is generally 5 to 7% for the major constituents of aluminum alloys. The activation method is valuable when only minute amounts of sample are available. (auth)

1154

SPECTROPHOTOMETRIC DETERMINATION OF URANIUM WITH 1-(2-PYRIDYLAZO)-2-NAPHTHOL. Harold H. Gill, R. F. Rolf, and G. W. Armstrong (Dow Chemical Co., Midland, Mich.). Anal. Chem. 30, 1788-92(1958) Nov.

From 40 to 400 γ of uranium can be determined by extraction of uranyl nitrate into a tributyl phosphate—chloroform solvent and subsequent color development in the organic extract with 1-(2-pyridylazo)-2-naphthol (PAN) in the presence of pyridine. The disodium salt of (ethylenedinitrilo)tetraacetic acid increased the selectivity of uranium extraction by chelating zirconium, bismuth, and manganese(II). Thorium is removed as thorium oxalate prior to extraction. Synthetic solutions containing uranium and 37 diverse ions were analyzed by the PAN and fluorometric procedures. The PAN procedure gave an average uranium recovery of 99% and an average deviation of ±2%. The fluorometric procedure gave an average recovery of 98% and an average deviation of ±4%. Analyses of alloys, ores, and organic extracts by the PAN and fluorometric methods are reported. (auth)

1155

SEPARATION AND DETERMINATION OF SMALL AMOUNTS OF RARE EARTHS IN URANIUM. Charles V. Banks, James A. Thompson, and Jerome W. O'Laughlin (Iowa State Coll., Ames). Anal. Chem. 30, 1792-5(1958) Nov.

A spectrophotometric method for the determination of total rare earths in the range 100 to 200 γ is presented. The chromophoric agent is 2-(1,8-dihydroxy-3,6-disulfo-2-naphthylazo)-benzenearsonic acid (arsenazo). The absorbance is measured at 570 mμ and pH 7.0. The main objective of this investigation was to develop a method of determining rare earths in the presence of large amounts of uranium and small amounts of iron. As both metals interfere in the proposed spectrophotometric method for rare earths, an ion exchange method of separation is presented which is based on the absorption of uranium(VI) sulfate and iron(III) thiocyanate on a quaternary ammonium anion exchange resin. (auth)

1156

DETERMINATION OF TRACES OF MIXED HALIDES BY ACTIVATION ANALYSIS. James F. Cosgrove, Robert P. Bastian, and Geroge H. Morrison (Sylvania Electric Products Inc., Bayside, N. Y.). Anal. Chem. 30, 1872-4(1958) Nov.

In order to evaluate the luminescent effects of halides on zinc sulfide phosphors, a neutron activation method has been developed to determine trace amounts of mixed halides. After activation, solvent extraction was used to isolate iodide and bromide. Chloride was isolated by distillation. The activity of the respective halides was measured by standard beta counting techniques. The accuracy and precision of the method are within 3.5%, and the limit of sensitivity is approximately 1 γ for chloride, 1 γ for iodide, and 0.001 γ for bromide. (auth)

1157

ANALYTICAL APPLICATIONS OF THE BARKER SQUARE-WAVE POLAROGRAPH. PART III. ORTHOPHOSPHORIC ACID AS A SOLVENT AND BASE ELECTROLYTE IN DIRECT INORGANIC POLAROGRAPHIC ANALYSIS. G. W. C. Milner and L. J. Slee (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Analyst 82, 139-51(1957)

Orthophosphoric acid is a versatile solvent for diverse materials and the resulting solutions may be analyzed polarographically. The polarographic behavior of several elements in a M phosphoric acid base solution has therefore been investigated, and half-wave potentials and diffusion-current constants are reported. With use of the square-wave polarograph, simple and direct procedures are described for the determination of small amounts of lead in copper, tin, zinc and aluminum-base alloys, respectively. The determination of lead (a few tenths of a per cent) in monazite and in various miscellaneous materials is also described. With no samples were chemical separations necessary after their dissolution in phosphoric acid. Direct procedures are also described for the determination of the copper content of lead, tin, and aluminum-base alloys, the zinc content of copper, tin, and aluminum-base alloys, and the cadmium content of tin and lead-base alloys. All the procedures outlined provide a considerable improvement on those in which use is made of conventional polarography. (auth)

1158

THE DETERMINATION OF CHROMIUM BY A SOLVENT-EXTRACTION METHOD. P. D. Blundy (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Analyst 83, 555-8(1958) Oct.

A method is described for the determination of small amounts of chromium in the presence of similar amounts of iron and nickel in solutions 0.04M in uranium and 0.005M in copper. The chromium is oxidized to chromate with ammonium hexanitratocerate in hot acid solution. The chromate is extracted with isobutyl methyl ketone from a solution M with respect to hydrochloric acid at a temperature of ≤ 10°C. The chromate is then extracted from the isobutyl methyl ketone by two successive water washes and is determined colorimetrically with diphenylcarbazide. In the presence of 100 μg each of nickel and iron, chromium was determined in the range 10 to 100 μg with a mean recovery of 100.3 % and a standard deviation of ±0.8 %.

1159

THE DETERMINATION OF NICKEL BY A SOLVENT-EXTRACTION METHOD. P. D. Blundy and M. P. Simpson (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Analyst 83, 558-61(1958) Oct.

A method is described for the rapid determination of nickel in solutions containing uranium, thorium, copper, iron, and chromium. The aqueous insoluble 4-methylcyclohexane-1:2-dionedioxime complex of nickel is extracted with toluene, and the optical density of this phase is measured with a Spekker absorptiometer, a Hilger H556 filter being used. Interference by copper is suppressed with thioglycollic acid, and tartaric acid is used to prevent formation of iron thioglycollate. Tartrate also prevents the hydrolysis of thorium. (auth)

1160

CALCULATIONS OF ACTIVITIES DERIVED FROM DECAY DATA AND CORRECTIONS FOR THE RESOLVING TIME OF THE APPARATUS. D. J. Apers, P. C. Capron, L. J. Gilly, and A. Vanderstricht (Univ. of Louvain, Belgium). Ann. soc. sci. Bruxelles 71, No. 3, 214-24(1957).

The technique of measuring activity for a longer than ordinary time and following the whole disintegration curve is discussed. The method increases accuracy and it can be applied to a mixture of radioactive materials provided their half lives are sufficiently different. In addition, correction for the counter resolving time can be introduced directly into the formula for calculation of the activity at the end of irradiation. (J.R.D.)

1161

METAL REFINING BY SOLVENT EXTRACTION OF LEACH SLURRIES. D. S. Arnold, B. G. Ryle, and J. O. Davis (National Lead Co. of Ohio, Cincinnati). Chem. Eng. Progr. 54, No. 10, 90-5(1958) Oct.

The general principles involved in refining uranium by slurry extraction of ore concentrates and high-grade ores are discussed. A description of the digestion and extraction techniques is presented emphasizing features peculiar to slurry extraction. It is pointed out that the introduction of solid particles into the tributyl phosphate—uranyl nitrate system has no effect on the chemical equilibrium; however, with respect to the physical properties of the extraction system and process stream handling, solid suspensions have a very real effect. (J.R.D.)

1162

CHEMICAL ENGINEERING IN THE INDUSTRIAL DEVELOPMENT OF BORON HYDRIDES. Lewis A. Barry (Callery Chemical Co., Penna.). Chem. Eng. Progr. 54, No. 10, 152-4, 156, 158(1958) Oct.

The problems confronting a boron hydride process designer are investigated. The most perplexing problems result from the extreme reactivity, moisture and air sensitivity, and toxicity of boron hydrides. Discussions of these problems and of the process at Callery Chemical Company are presented. (J.R.D.)

1163

ALKYLGERMANIUM HYDRIDES AND ALKYLGERMANIUM DEUTERIDES. V. A. Ponomarenko, G. Ya. Vzenkova, and Yu. P. Egorov (Zelenskii Inst. of Organic Chemistry, Academy of Sciences, USSR). Doklady Akad. Nauk. 122, 405-8(1958) Sept. 21. (In Russian)

Descriptions are given of the preparation and properties of organic germanium hydrides and deuterides: $CH_3GeH_3 \rightarrow (CH_3)_2GeH_2 \rightarrow (CH_3)_3GeH$; $CH_3GeD_3 \rightarrow$

$(CH_3)_2GeD_2 \rightarrow (CH_3)_3GeD$; $C_2H_5GeH_3 \rightarrow (C_2H_5)_2GeH_2 \rightarrow (CH_3)_2(C_2H_5)GeH$; $C_2H_5GeD_3 \rightarrow (C_2H_5)_2GeD_2 \rightarrow (CH_3)_2(C_2H_5)GeD$. (R.V.J.)

1164

PHOTOCHEMISTRY OF COMPLEX IONS. I. SOME PHOTOCHEMICAL REACTIONS OF AQUEOUS $PtBr_6^{-2}$, $Mo(CN)_8^{-4}$ AND VARIOUS Co(III) AND Cr(III) COMPLEX IONS. Arthur W. Adamson and A. H. Sporer (Univ. of Southern California, Los Angeles). J. Am. Chem. Soc. 80, 3865-70(1958).

Studies have been made of the photochemistry of aqueous $Co(NH_3)_6^{3+}$, $Co(NH_3)_5X^{2+}$ (X = SCN, Cl, I), $Co(CN)_5X^{3-}$ (X = CN, Cl, Br, I), $Co(C_2O_4)_3^{3-}$, $Cr(NH_3)_5SCN^{2+}$, $Cr(NH_3)_2(SCN)_4^-$, $Cr(C_2O_4)_3^{3-}$, $Mo(CN)_8^{4-}$, and the exchange system $PtBr_6^{2-}$–Br^- Quantum yields were obtained for the oxidation-reduction decompositions, aquation, racemization or exchange reactions that occurred, usually for two wave lengths, one in the ligand field band region and one in the electron transfer band region of the absorption spectra. The results are interpreted to indicate that the chemical nature of the excited state is qualitatively independent of the wave length of the light used. On the other hand, the net consequence of light absorption depends upon which of several possible courses is taken subsequent to the formation of the primary excited state. (auth)

1165

THE PREPARATION AND PROPERTIES OF SOME PLUTONIUM COMPOUNDS. PART VIII. PLUTONIUM(IV) SULPHATE. J. L. Drummond and G. A. Welch (U. K. Atomic Energy Authority, Dounreay, nr. Thurso, Caithness, Eng.). J. Chem. Soc. 3218-19(1958) Sept.

Plutonium(IV) sulfate was prepared from purified plutonium nitrate solution by repeated evaporation with fuming sulfuric acid and heating between 450 and 650°C. The sulfate was moistened with 18N sulfuric acid and heated at the same temperature until the weight was constant to within 0.1%. (auth)

1166

ON THE STUDY OF REMOVAL OF RARE-EARTHS AND UX_1 FROM BERYLLIUM, ALUMINIUM, ZIRCONIUM AND URANIUM. B. C. Purkayastha and M. Ganguli (Inst. of Nuclear Physics, Calcutta). J. Indian Chem. Soc. 35, 499-502(1958) July.

Rare earths and Th^{234} were removed from U, Be, Al, and Zr by agitation in acetic acid with solid calcium oxalate monohydrate added. Decontamination of these metals to a level of 1 ppm may be achieved with two such operations in succession. (J.R.D.)

1167

ON THE BEHAVIOR OF LIQUID DROPLETS AFTER IMPINGING ON SOLID SURFACES. Isaiah Gallily and Victor K. La Mer (Columbia, Univ., New York). J. Phys. Chem. 62, 1295-9(1958) Oct.

The deposition of particles impinging on solid surfaces was investigated for a system composed of a two-dimensional jet of glycerol aerosol and Desicote-coated glass microscope slides inclined to it. The patterns of the particles deposited in these experiments were found to change with the velocity of the jet and the radius of the aerosol contrary to the way usually expected. They indicate that a certain fraction of the particles bounces off from the surface on first contact. A qualitative explanation of the phenomena found is offered. (auth)

1168

THE OXIDATION-REDUCTION COUPLES U(IV)-U(VI) AND Fe(II)-Fe(III) IN PHOSPHORIC ACID SOLUTIONS. Y. Marcus (Israel Atomic Energy Commission Labs., Rehovoth). J. Phys. Chem. 62, 1314-18(1958) Oct.

The potentials of the U(IV)-U(VI) and the Fe(II)-Fe(III) couples in 1.2 to 7.5 M phosphoric acid were measured at 25° and formal potentials E′ were calculated. Plots of E'_U and E'_{Fe} vs. log $a_{H_3PO_4}$, the phosphoric acid activity, were linear, with slopes of $(+3.2 \pm 0.2) \times 0.60/2$ mv and $(-1.3 \pm 0.1) \times 60$ mv, respectively. For 1 M phosphoric acid the values are $E'_U = -475 \pm 10$ mv and $E'_{Fe} = -555 \pm 10$ mv vs. the normal hydrogen electrode. Solutions of U(IV), in sharp contrast to Fe(II), in phosphoric acid are very stable to air oxidation. The behavior of iron and uranium ions, singly or mixed, in phosphoric acid solutions was found to be as might be predicted from the single formal potentials. At phosphoric acid concentrations above 2.4 M Fe(II) reduces U(VI), and at concentrations below 1.2 M Fe(III) oxidizes U(IV). (auth)

1169

THERMODYNAMIC PROPERTIES OF SOME FUSED CHLORIDES. B. F. Markov, J. K Delimarsky, and I. D. Panchenko (Inst. of General and Inorganic Chemistry, Academy of Sciences of the Ukrainian S.S.R., Kiev). J. Polymer Sci. 31, 263-8(1958) Sept.

The stability of complexes and associates formed in compound molten electrolytes can be quantitatively estimated from the excess thermodynamic functions (free enthalpy, entropy, enthalpy). These functions can be most conveniently determined by measuring the electromotive force of chemical cells of the type $Me_I[Me_IX_m, Me_{II}X_n]X_2$, where X is halogen. In this way the following systems were experimentally investigated: $BeCl_2$–NaCl; $MgCl_2$–LiCl; $MgCl_2$–NaCl; $MgCl_2$–KCl; $MgCl_2$–RbCl; $PbCl_2$–LiCl; $PbCl_2$–NaCl; $PbCl_2$–KCl; $PbCl_2$–RbCl. The dependence of the excess partial free enthalpy on the mole fraction can be expressed by the equation $Z_1^E = \alpha(1 - X_1)^\beta$, where α and β are constants (for example $\beta = 2.4$ for $PbCl_2$). In logarithmic coordinates, $(Z^E; (1 - X_1))$, the experimentally determined data show a linear dependence. A curve-linear dependence in these coordinates indicates a deviation from an ideal system. According to the magnitude of these deviations, it is possible to judge the stability of the complexes in the melts. The stability of the complexes in the melts regularly increases in the order LiCl, NaCl, KCl, RbCl. (auth)

1170

DEUTERIUM ISOTOPE EFFECT IN INHIBITED OXIDATION OF BUTADIENE-STYRENE RUBBER. J. Reid Shelton and E. T. McDonel (Case Inst. of Tech., Cleveland). J. Polymer Sci. 32, 75-82(1958) Oct.

The importance of hydrogen abstraction by peroxy radicals as a mechanism of antioxidant action in rubber has been studied by investigation of a deuterium isotope effect with amine and phenolic inhibitors in the oxidation of butadiene–styrene rubber. Deuterium was substituted for the active hydrogen of N-phenyl-2-naphthylamine and 2,6-di-tert-butyl-4-methylphenol by reacting the antioxidants with methylmagnesium iodide and then with deuterium oxide. The oxidation rates of butadiene–styrene polymer inhibited with 3 parts per hundred of these compounds were measured and compared with the oxidation rates using normal antioxidants. A kinetic isotope effect in the rate of oxidation was observed with both the phenolic inhibitor ($k_D/k_H = 1.3$ with not less than 77% substitution) and the amine inhibitor ($k_D/k_H = 1.8$ with not less than 60% substitution). The existence of an isotope effect leads to the conclusion that hydrogen donation to a peroxy radical is a controlling step in the mechanism by which these antioxidants function to retard the oxidation of rubber. (auth)

1171

THE PREPARATION OF THORIUM METAL BY SODIUM AMALGAM REDUCTION OF THORIUM CHLORIDE: THE METALLEX PROCESS. O. C. Dean and G. K. Ellis (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 4, 509-21(1958) Oct.

A process, developed at Oak Ridge National Laboratory, produced thorium metal by the continuous reduction of anhydrous thorium tetrachloride with sodium amalgam on a scale up to 3.5 pounds per hour. The salt was vigorously agitated with an excess of sodium amalgam which was produced by the electrolysis of aqueous sodium hydroxide. The resulting slurry of thorium mercuride in mercury was washed free from impurities and reaction by-products with dilute HCl and water. A solid concentrate of the thorium mercuride was prepared by filter-pressing the dilute slurry. The remaining mercury was removed by vacuum-distillation, resulting in massive metal of about 0.8 of the theoretical thorium density. The metal was fabricated into rods by direct extrusion or by arc-melting followed by extrusion. (auth)

1172

STUDIES ON TRAVANCORE MONAZITE. VI. INVESTIGATION OF THE SOLID-SOLID REACTION BETWEEN MONAZITE AND SODIUM CARBONATE BY DIFFERENTIAL THERMAL ANALYSIS AND BY X-RAY DIFFRACTION. K. N. N. Kurup and S. S. Moosath (Univ. of Kerala, Trivandrum, India). Proc. Indian Acad. Sci. A48, 76-83(1958) Aug.

Results of investigations by differential thermal analysis and x-ray diffraction of the solid-solid reaction between monazite sand and sodium carbonate are presented. The differential thermal analysis curve shows that it is a slow exothermic reaction. X-ray-diffraction patterns, besides confirming the constituents in the sintered products identified chemically, show the presence of a new phase. (auth)

1173

ELECTROLYTIC PURIFICATION OF CARRIER FREE TELLURIUM TRACER. A. S. Ghosh Mazumdar (Institut du Radium, Paris). Proc. Indian Acad. Sci. A48, 106-10(1958) Aug.

Tellurium(IV) is reduced to the metallic state by electrolysis of acidic solutions, whereas tellurium(VI) is not. Radio-tellurium behaves similarly at tracer concentration. A smooth well-adhering macro-deposit of tellurium metal can be obtained by electrolysis of 10^{-3} N solution of tellurium(IV) in hydrobromic acid. (J.R.D.)

1174

PHOTOCHEMICAL REACTIONS OF SOME Co(III) AND Cr(III) COMPLEXES. Arthur W. Adamson and Alfred H. Sporer (Univ. of Southern California, Los Angeles). Ricerca sci. 28, Suppl. 8p.(1958).

Studies have been made of the photochemistry of aqueous $Co(NH_3)_6^{3+}$, $Co(NH_3)_5X^{2+}$ (X = SCN, Cl, I), $Co(CN)_5X^{3-}$ (X = CN, Cl, Br, I), $Co(C_2O_4)_3^{3-}$, $Cr(CH_3)_5SCH^{2+}$, $Cr(NH_3)_2(SCN)_4^-$, and $Cr(C_2O_4)_3^{3-}$. Quantum yields were obtained for the redox decompositions, aquation, or racemization processes that occurred, usually for two wave lengths, one in the ligand field band region, and one in the electron transfer band region of the absorption spectra. In addition, quantum yields were obtained for the photochemically induced oxidation of iodide ion in the presence of $Co(NH_3)_6^{3+}$ and $Co(NH_3)_5Cl^{2+}$. The results are interpreted to indicate that the chemical nature of the excited state is qualitatively independent of the wave length of the light used. On the other hand, the net consequence of light absorption depends upon which of several possible courses is taken subsequent to the formation of the primary excited state. (auth)

1175

FLÜSSIGE ANIONENAUSTAUSCHER. (Liquid Anion Exchangers) U. Schindewolf (Massachusetts Inst. of Tech., Cambridge) and (Univ. of Michigan, Ann Arbor). Z. Electrochem. 62, 335-40(1958). (In German)

The solution of the hydrochloride of an organic long-chain amine in a water-immiscible solvent (liquid anion exchanger) acts as a strong anion exchanger. These liquid anion exchangers absorb or extract chloro-complexes of many metals from chloride-containing electrolytes with great anionic selectivity. The form of the distribution curve (partition coefficient vs. activity of chloride-containing carrier-electrolyte) is given by means of the aqueous phase reaction which leads to the formation of the absorbed complexes, and by means of the exchange reaction in the organic phase. The electrolyte effect observed in the case of strong anion exchangers (deviation from ideal behavior) is also characteristic of liquid anion exchangers. Varying the amine concentration in the organic phase presents a simple means of studying the influence of active groups on ion exchange. (tr-auth)

1176

ANALYTICAL APPLICATION OF 8-MERCAPTOQUINOLINE (THIOOXINE) AND ITS DERIVATIVES. COMMUNICATION II. PHOTOMETRIC DETERMINATION OF SMALL AMOUNTS OF PALLADIUM. Yu. A. Bankovskii and A. F. Ievinsh (Inst. of Chemistry, Academy of Sciences, Latvian S.S.R.). Zhur. Anal. Khim. 13, 507-12 (1958) Sept.-Oct. (In Russian)

Palladium thiooxine Pd $(C_9H_6NS)_2 \cdot H_2O$ is stable in strongly acid solutions and can be easily extracted by the most of organic solvents with the development of an intensive pink color. A highly specific photometric method was developed for determining palladium (5–270 μg) in the presence of prevalent quantities of foreign elements such as Pt, Os, Ru, Rh, Ir, Cu, Ag, Au, Hg, Fe, Ni, Co, Zn, Cd, Ge, Mn, Tl, As, Sb, Bi, Sn, Se, W, Mo, Pb, U, Y, and others. (tr-auth)

1177

SEPARATION OF THORIUM FROM TITANIUM, ZIRCONIUM AND OTHER ACCOMPANYING ELEMENTS BY HOMOGENEOUS PRECIPITATION. F. V. Zaikovskii and L. I. Gerkhardt (All-Union Inst. of Mineral Ray Materials). Zhur. Anal. Khim. 13, 513-18 (1958) Sept.-Oct. (In Russian)

It was established that the precipitation of thorium from a homogeneous solution by acetone dioxalic acid has the advantage over the usual oxalate method: a coarse-crystalline easily filtered precipitate is formed, the co-precipitation of zirconium and titanium is almost absent. Thorium oxalate can be quantitatively precipitated directly, without any additional operations, in the presence of foreign ions. A new method was developed for determining small amounts of thorium (0.002 to 3.0%) in natural materials by homogeneous precipitation with arsenazo I. (tr-auth)

1178
ON CHROMOMETRIC DETERMINATION OF SEXAVALENT MOLYBDENUM WITH TUNGSTEN AND OTHER ELECTRODES. A. I. Busev and Li Gyn (Lomonosov Moscow State Univ.). Zhur. Anal. Khim. 13, 519-27 (1958) Sept.-Oct. (In Russian)

The titration of sexavalent molybdenum in hydrochloric and sulfuric acid mediums with a solution of a bivalent chromium salt was studied with various indicator electrodes (platinum, mercury, amalgamated platinum, graphite, tungsten, tantalum). A chromometric method was developed for determining molybdenum in ferromolybdenum with the use of a tungsten indicator electrode. (tr-auth)

1179
DETERMINATION OF BI- AND TRIVALENT TITANIUM IN SLAGS CONTAINING METALLIC AND BIVALENT IRON. L. I. Veselago (Baikov Inst. of Metallurgy, Moscow). Zhur. Anal. Khim. 13, 562-6(1958) Sept.-Oct. (In Russian)

A method was developed for the separate determination of bi- and trivalent titanium in slags containing metallic and bivalent iron. (tr-auth)

1180
SPECTROCHEMICAL DETERMINATION OF TANTALUM IN ZIRCONIUM. S. V. Elinson, K. I. Petrov, and A. T. Rezova. Zhur. Anal. Khim. 13, 576-9(1958) Sept.-Oct. (In Russian)

A spectrochemical method is suggested for determining small amounts (<0.01%) of tantalum in zirconium. The method is based on the separation of tantalum from zirconium by extracting a tantalum fluoride complex with cyclohexanone from a H_2SO_4 medium followed by the spectrographic determination of tantalum in the solution after distilling off cyclohexanone as azeotropic mixture. Molybdenum was used as an internal standard. The method permits determining up to 1×10^{-3} % of tantalum per g of zirconium with the mean arithmetical error of 20% relative. (tr-auth)

1181
QUANTITATIVE DETERMINATION OF FLUORINE BY FORMATION OF HYDROXYTRIFLUOROBORATES. A. L. Goldinov, V. I. Lukhovitskii, M. A. Gorovits, and B. S. Roginskaya. Zhur. Anal. Khim. 13, 583-5(1958) Sept.-Oct. (In Russian)

A method for the quantitative determination of fluorine was developed, based on the conductimetric titration of borax formed by the reaction: $3NaF + 5H_3BO_3 = NaBF_3OH + Na_2B_4O_7 + 7H_2O$. The method was used for the determination of fluorine in cobalt, manganese and antimony fluorides. (tr-auth)

1182
PHOTOMETRIC DETERMINATION OF COBALT AS COBALTINITRITE. Florin Modryanu and Nicholae Iorga (Jassy, Roumania). Zhur. Anal. Khim. 13, 617-18 (1958) Sept.-Oct. (In Russian)

It was shown that small amounts of cobalt can be determined by a photometric method as cobaltinitrite. Beer's law is obeyed within the range of concentrations from 0.35 to 1.50 mg/ml of Co^{2+}. No interference is caused by the large quantities of UO_2^{2+} ions. (tr-auth)

Radiation and Radiochemistry

1183 AECU-3881
Oak Ridge Gaseous Diffusion Plant, Tenn.
URANIUM ISOTOPIC ANALYSIS BY EMISSION SPECTROGRAPHY. A Literature Search. Alice S. Behr, comp. Dec. 9, 1957. 6p. Contract W-7405-eng-26. (KLI-4271(Del.)). $1.80(ph OTS); $1.80(mf OTS).

Thirty-one journal and report references are listed on uranium isotopic analysis by emission spectrography. (A.C.)

1184 BNL-493
Brookhaven National Lab., Upton, N. Y.
AN ABSORPTION PROCESS FOR RECOVERY OF FISSION PRODUCT NOBLE GASES. M. Steinberg and B. Manowitz. Feb. 1958. 18p. $0.75(OTS).

The design of a liquid absorption stripping process for removal and concentration of xenon and krypton from spent fuel processing cycles is presented. In addition, the adsorption of these gases on charcoal is reviewed. Xenon and krypton solubility in a number of solvents was determined by a modified McDaniel procedure and by radioactive tracer techniques. The rate of absorption of the noble gases appears to be liquid-film controlled and is expressed as a function of the solvent mass flow rate. (J.R.D.)

1185 HW-54735
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
DECONTAMINATION OF ALUMINUM-PLUTONIUM ALLOYS. Y. B. Katayama. Jan. 28, 1958. 4p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

Ultrasonically agitated $HF-HNO_3$ solutions were used to loosen the contamination particles from the alloy surface. A flowing water rinse cycle with continuous ultrasonic agitation flushed out the loosened radioactive particles leaving a nonmeasurable surface after drying. Al alloys with up to 15 wt. % Pu were decontaminated. (J.R.D.)

1186 NP-6992
Brussels. Centre D'Étude de l'Énergie Nucléaire.
TRAITEMENT CHIMIQUE DES MINERAIS PAUVRES D'URANIUM. EXTRACTION DE L'URANIUM DU PHOSPHATE TRICALCIQUE. (Chemical Treatment of low-grade uranium ores. Extraction of Uranium from Tricalcium Phosphate). Ph. Mechelynck. July 1958. 7p.

After an examination of the different processes for the treatment of uranium minerals, it is concluded that the extraction of uranium by ion exchange is not applicable to hydrochloric acid solutions of phosphates. A sulfuric or phosphoric solution can be used. For solvent extraction of uranium, sulfuric or phosphoric solutions are the best, but hydrochloric solutions can be used. The cost of the solvents used would determine the cost of the operation. It is necessary, in the case of liquid-liquid extraction, to filter or decant the solution before extraction. (tr-auth)

1187 NP-7022
Rio de Janeiro. Centro Brasileiro de Presquisas Físicas.
COBALT-60 FROM THERMONUCLEAR TESTS IN THE ATMOSPHERE. Luiz Marquez, Neyla Leal da Costa, and Ivone G. de Almeida. May 22, 1958. 10p. (Notas de Física Vol. IV, No. 6).

Rain water that fell between June 1957 and March 1958 was analyzed for the presence of fission products. Cobalt-60 was found in concentrations of 0.0066 dpm/liter. Evidence indicates that this cobalt-60 came from thermonuclear weapons tests. (C.H.)

1188 NP-7023
Rio de Janeiro. Centro Brasileiro de Presquisas Físicas.

RADIOISOTOPES FROM FUSION IN RAIN WATER: Co^{57}, Mn^{54} AND Co^{60}. L. Marquez, N. L. Costa, and I. G. Almeida. June 4, 1958. 7p. (Notas de Física Vo. IV, No. 7).

Rain water that fell between June 1957 and March 1958 was analyzed for the presence of fission products. Samples were counted in a well crystal scintillation spectrometer. The spectra of Co^{57}, Mn^{54}, and Co^{60} were identified in concentrations indicating the activity came from fission products resulting from thermonuclear weapons tests. (C.H.)

1189 USNRDL-TR-268

Naval Radiological Defense Lab., San Francisco.
FISSION YIELDS IN NEUTRON FISSION OF Pu^{239}. L. R. Bunney, E. M. Scadden, J. O. Abriam, and N. E. Ballou. Oct. 10, 1958. 10p.

Some fission yield data pertinent to solution of radiological problems resulting from nuclear weapons detonations have been obtained. The portion of the Pu^{239} fission yield curve which includes the heavier mass numbers has not been clearly defined by radiochemical measurements. The radionuclides produced in this mass region fall in the rare earth group and until recent years adequate separation procedures were not available for all cases of interest. Rare earth fission yield data for Pu^{239} were previously reported only for masses 144, 153, and 156. Mass spectrometric measurements of yields are difficult in this region due to frequent high neutron cross sections. Information on the more accurate definition of the Pu^{239} fission yield curve in the heavy mass region is presented. Radiochemical studies, utilizing ion exchange chromatography, of the "pile" neutron fission of Pu^{239} were made. Chain yields were measured relative to Mo^{99} for masses 144, 147, 149, 153, 156, 159, 161, and 166. In comparison with U^{235}, the Pu^{239} yields show increases of a few percent to a factor of more than 20 in the heavier rare earth products. (auth)

1190 NP-tr-166

STATE OF URANIUM IN OCEAN WATER. I. E. Starik and L. B. Kolyadin. Translated by R. C. Murray (U.K.A.E.A. Atomic Energy Research Establishment) from Geokhimiya, No. 3, 204-13(1957). 21p.

Factors which influence the concentration of uranium in ocean waters are discussed. (C.H.)

1191 NP-tr-178

CHEMICAL TRANSFORMATIONS OF SUGARS BY CATHODE RAYS. I. THE REACTION OF IRRADIATED LACTOSE WITH THIOBARBITURIC ACID. H. Streuli. Translated for U.K.A.E.A. Atomic Energy Research Establishment from Mitt. Gebiete Lebensm. u. Hyg. 47, 221-31(1956). 67p.

Sugar solutions, to which thiobarbituric acid was added, were observed to turn brown during and subsequent to exposure to cathode rays. An attempt was made to clarify the various types of radiation browning of sugars in terms of certain external criteria. (C.H.)

1192

THE PURIFICATION AND DEPOSITION OF IRRADIATED PLATINUM BY PREFERENTIAL DISTILLATION. G. V. Kidson and W. L. Elsdon (Atomic Energy of Canada Ltd., Chalk River, Ont.). Intern. J. Appl. Radiation and Isotopes 3, 252-3(1958) Aug.

A simple and rapid technique is described for the purification and deposition of a thin layer of radioactive platinum on a diffusion sample. A piece of irradiated platinum foil was cooled 48 hours and then placed on a tungsten filament in an evacuation chamber. By passing a large current through the filament, the platinum was melted and evaporated onto a disk placed above it. By continuous evaporation a point was reached at which all of the gold impurity was removed. (C.H.)

1193

DEGRADATION OF DL-METHIONINE BY RADIATION. Jirina Kopoldova, Jaroslav Kolousek, Arnost Babicky, and Jindrich Liebster (Czechoslovak Academy of Sciences, Prague). Nature 182, 1074-6(1958) Oct. 18

The degradation of DL-methionine by x and β rays was studied chromatographically with special regard to the degradation products containing sulfur-35. Data are presented on the quantitative relations between the irradiation dose, the amount of ammonia liberated, and the decrease of methionine following irradiation. (C.H.)

1194

BORON-10 ABUNDANCE IN NATURE. P. G. Bentley and A. N. Hamer (United Kingdom Atomic Energy Authority, Capenhurst, Chester, Eng.). Nature 182, 1156(1958) Oct. 25.

The mass spectrometer discriminations, expressed as a fraction of the isotope ratio, were found to be the same for both enriched and natural boron trifluoride. The naturally occurring boron sample was found to contain 19.3 ± 0.1 per cent of boron-10. (C.H.)

1195

RADICAL YIELD MEASUREMENTS IN IRRADIATED AQUEOUS SOLUTIONS. I. RADICAL YIELDS WITH Co^{60} GAMMA RADIATION. D. M. Donaldson and N. Miller (Univ. of Edinburgh). Radiation Research 9, 487-97(1958) Nov.

Studies have been made of the γ-ray-induced reduction of ferric ion in dilute sulfuric acid solutions containing cupric ion and formic acid. By suitable adjustment of the concentrations of these three species, a set of conditions has been found in which the ferrous ion yield gives a direct measure of the sum $G_H + G_{OH}$. The radical scavenging action of increasing concentrations of cupric ion and formic acid has been investigated, again with Co^{60} γ-rays, and found to be in accord with the predictions of the radical diffusion theory. (auth)

1196

PRODUCTION OF CARBONYL COMPOUNDS AND SULFUR COMPOUNDS ON IRRADIATION OF AMINO ACIDS. Luis Duran and A. L. Tappel (Univ. of California, Davis). Radiation Research 9, 498-501(1958) Nov.

Hydroxy amino acids gave the highest yield of carbonyl compounds on irradiation. The irradiation of methionine produced carbonyls, ammonia, hydrogen sulfide, and mercaptans. Irradiated methionine gave the most intense odor, and this odor was characteristic of the mercaptans. (auth)

1197

THE RADIATION CHEMISTRY OF AQUEOUS NITRITE SOLUTIONS: THE HYDROGEN PEROXIDE YIELD. Harold A. Schwarz and Alice J. Salzman (Brookhaven National Lab., Upton, N. Y.). Radiation Research 9, 502-8(1958) Nov.

Earlier data on γ-ray-induced reactions of nitrite ion in water have been extended and refined. Revised values of the yield of H_2O_2 produced in the irradiation of these solutions are in better agreement with expectation than were the older values. The reaction of H atoms with the product NO_3^- is shown to account for the differences in conclusions between the two studies. (auth)

1198

PROTECTION PROVIDED BY ADDED SUBSTANCES

AGAINST THE DIRECT ACTION OF IONIZING RADIATIONS. P. Alexander and D. J. Toms (Royal Cancer Hospital and Imperial Coll., London). Radiation Research 9, 509-24(1958) Nov.

Preliminary work had shown that the degradation of solid polymethyl methacrylate by ionizing radiations could be reduced by the addition of low-molecular-weight substances to the polymer. This effect has now been studied in more detail. The relationship between concentration of additive and the extent of protection has been studied for 8-hydroxyquinoline and naphthalene. With 8-hydroxyquinoline the protective effect decreases with radiation dose, and it is concluded that the additive is rendered less protective as a result of radiation changes. The proportion of 8-hydroxyquinoline that reacts in this way is greatest in films where its concentration is lowest. This suggests that this radiochemical change is not in the main due to direct action on the 8-hydroxyquinoline but that energy originally deposited in the polymer contributes. Over the dose range studied the protection offered by naphthalene is constant, and this is probably due to its greater radioresistance. With radioactive naphthalene the quantity of protector that combines with the polymer has been measured. The amount is much less than the number of breaks that the presence of the naphthalene had prevented from appearing. Consequently the reduction in damage cannot arise from the protective agent joining together broken main chains. It is concluded that protection is the result of a transfer process by which the energy deposited in the polymer is diverted to the protective agent in the interval between the occurrence of ionization and the appearance of the final radiation-chemical change. The fact that so many substances having quite diverse chemical properties can protect supports the energy-transfer mechanism rather than one involving repair of the damaged polymer molecule. (auth)

1199

HEAT OF OXIDATION OF URANIUM OXIDES. Aurelio Burdese and Fedele Abbattista (Istituto di chimica generale e applicata e di metallurgia del Politecnico, Turin). Ricerca sci. 28, 163-8(1958) Aug. (In Italian)

By means of the direct determination of the heat of dissolution of uranium oxides in nitric solution, the heats of the following oxidation reactions were determined: $UO_2 \rightarrow \frac{1}{4} U_4O_9 \rightarrow \frac{1}{3} U_3O_8 \rightarrow UO_3$. The values found for $-\Delta H$(kcal/g atom of U) were 12.6, 14.9, and 7.6, respectively. (tr-auth)

1200

FRANCIUM PROPERTIES. A. K. Lavrukhina. Uspekhi Khim. 17, 1209-20(1958) Oct. (In Russian)

Data are presented on the preparation methods, chemical behavior, properties, and applications of francium and its isotopes. 61 references are included. (R.V.J.)

Separation Processes for Pu and U

1201 AECU-3879

Michigan. Univ., Ann Arbor.

TTA EXTRACTION CURVES. E. Sheperd and W. W. Meinke. Oct. 24, 1958. 5p. Project No. 7. Contract AT(11-1)-70. $1.80(ph OTS); $1.80(mf OTS).

Curves are given of pH versus percent extraction for Ac, Be, Bi, Ce, Dy, Eu, Gd, Hf, Ho, In, Fe, La, Pb, Nd, Np, Pu, Pr, Pm, Ra, Sm, Sc, Tl, Tm, Th, U, V, and Y by thenoyl trifluoroacetone in benzene. (T.R.H.)

1202 HW-56674

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

DENSITY MONITOR FOR PUREX HA COLUMN. C. E. Huck. July 16, 1958. 17p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

A densimeter system is described which was developed for use on HA column. Reproducibility of instrument readings is ± 2½% of recorder span for pulser frequencies of 44 to 104 cycles per minute. The effects of column pulsations and column static pressure at the feed point are small. Simulated column feed point static pressure of 10 psig caused improved precision due to added damping of float oscillations. (auth)

1203 K-945

Carbide and Carbon Chemicals Co. K-25 Plant, Oak Ridge, Tenn.

STUDIES OF THE RATE OF REACTION BETWEEN METALLIC URANIUM AND SOLUTIONS OF CHLORINE TRIFLUORIDE AND HYDROGEN FLUORIDE. R. A. Gustison and E. J. Barber. Oct. 8, 1952. Decl. Oct. 29, 1957. 16p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

The temperature dependence of the rate of reaction between metallic uranium and a solution containing about 0.3 moles of chlorine trifluoride per mole of hydrogen fluoride was determined between 10 and 80°C. The data indicate that at 75°C about 29 hrs would be required to dissolve a Hanford slug and that at 80°C about 18 hrs would be required. The dependence of the rate of reaction on temperature underwent an abrupt change at about 48°C, becoming more dependent above this temperature. The reaction proceeded smoothly at all temperatures investigated. The experimental activation energy of the high temperature reaction was found to be 18.5 kcal $mole^{-1}$ and the entropy of activation and free energy were calculated to be about −33 cal. $mole^{-1}$ $degree^{-1}$ and 30 kcal $mole^{-1}$ at 373°K, respectively. Similar data were collected for the reaction of metallic uranium with liquid and gaseous chlorine trifluoride. (auth)

1204 ORNL-1425(Del.)

Oak Ridge National Lab., Tenn.

SEPARATION OF U^{233} IN THE ORNL PILOT PLANT. C. D. Hylton. Dec. 30, 1952. Decl. with deletions Sept. 23, 1958. 36p. Contract W-7405-eng-26. $6.30 (ph OTS); $3.00(mf OTS).

Hot operations in pilot plant separation of U^{233} from irradiated thorium are described. The operation was carried out in the facility formerly used for the 23 pilot plant. After extensive modification, no serious mechanical or processing difficulties were encountered. The process rate was 75 kg of thorium per day. (J.R.D.)

1205 AEC-tr-3431

OPERATION PLAN OF THE NUCLEAR FUEL DEVELOPMENT CORPORATION. Translation of an article from Nippon Keizai Shimbun (1957) Nov. 2p.

The Nuclear Fuel Development Corporation at Aza Muramatsu Tokai-mura, Naka-gun, Japan, is concerned with prospecting for uranium and thorium and refining nuclear fuels. Buildings and facilities are reported under construction, with some operations scheduled for the autumn of 1958. Facilities for research work will also be built. A rough budget and brief description of the planned facilities are presented. (C.H.)

1206

SEPARATION OF URANIUM BY SOLVENT EXTRACTION WITH TRI-N-OCTYLPHOSPHINE OXIDE. DI-

RECT COLORIMETRIC DETERMINATION WITH DIBENZOYLMETHANE. Charles A. Horton and J. C. White (Oak Ridge National Lab., Tenn.). Anal. Chem. 30, 1779-84(1958) Nov.

A simple, rapid method for the determination of ıranium in impure aqueous solutions was developed. Uranium(VI) is extracted by 0.1M tri-n-octylphosphine oxide in cyclohexane from a nitric acid solution. A yellow color is formed in an aliquot of the organic extract by addition of dibenzoylmethane and pyridine in ethyl alcohol. Interference by cations is minimized or eliminated by selective reduction, by fluoride complexation, or by absorbance measurement at 416 mμ rather than 405 mμ, the wave length of maximum absorbance. Interference by excess fluoride or phosphate s eliminated by addition of aluminum nitrate before extraction. The range of the method is 20 to 3000 γ of ıranium in the original solution, and the standard deviation is ± 2%. (auth)

1207

SEPARATION OF URANIUM FROM BISMUTH BY ANION EXCHANGE RESINS. Gurupada Banerjee and Arno H. A. Heyn (Boston Univ., Mass.). Anal. Chem. 30, 1795-7(1958) Nov.

A method for the ready separation of trace amounts of uranium from large excess of bismuth allows for subsequent determination of uranium. At pH between .0 and 1.5 the sulfate complex of uranium(VI) is quantitatively retained by a quaternary amine-type anion exchange resin while the cationic bismuth ion passes through the column. Uranium can then be eluted for analysis by dilute perchloric acid. The method can be used for the separation of microgram quantities of ıranium from bismuth, permitting the routine determination of uranium. (auth)

1208

DETERMINATION OF URANIUM WITH THE USE OF POTASSIUM IODATE. E. S. Przhevalskii, E. R. Nikolaeva and N. I. Udaltsova (Lomonosov Moscow State Univ.). Zhur. Anal. Khim. 13, 567-9(1958) Sept.-Oct. (In Russian)

Conditions were established for precipitating tetravalent uranium iodate of constant composition according to the formula $U(IO_3)_4$. The iodate method is suitable for the gravimetric and titrimetric determination of ıranium. The influence of some elements on the accuracy of determination was studied. The possibility was established for the determination of uranium in the presence of aluminum. Iron must be separated beforehand. (tr-auth)

1209

SEPARATION OF URANIUM AND VANADIUM. Yu. V. Morachevskii, A. I. Belyaeva, and L. V. Ivanova (Zhdanov Leningrad State Univ.). Zhur. Anal. Khim. 13, 570-5(1958) Sept.-Oct. (In Russian)

It was shown that the difficulty in the analytical separation of uranium (VI) from vanadium (V) lies in the formation of stable uranovanadium complexes. Three ıranovanadic acids and their ammonium salts were isolated. The solubility of the salts was determined. (tr-auth)

CONTROLLED THERMONUCLEAR PROCESSES

1210 AECD-3745

Princeton Univ., N. J. Project Matterhorn.

HYDROMAGNETIC INSTABILITIES CAUSED BY RUNAWAY ELECTRONS. J. Dawson and I. B. Bernstein. [195?]. Decl. Aug. 21, 1958. 6p. (PM-336). $1.80 (ph OTS); $1.80(mf OTS).

The possibility of the excitation of hydromagnetic instabilities caused by a beam of runaway electrons is investigated. It is found that if the wave length and frequency of the wave are such that the Doppler shift of the frequency due to the runaways' motion causes the electrons to see their cyclotron frequency, and if the electric field rotates in the same direction as the electrons do about the confining magnetic field, then an instability occurs. (auth)

1211 KAPL-M-LGB-14

Knolls Atomic Power Lab., Schenectady, N. Y.

A FUSION-FISSION REACTOR. L. G. Barrett. June 27, 1957. Decl. Oct. 13, 1958. 13p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

The proposed reactor consists of three regions: Stellarator, a Li^6 blanket, and a UO_2SO_4 coolant which, as a subcritical reactor, can preheat the Stellarator chamber. (A.C.)

1212 LA-1586

Los Alamos Scientific Lab., N. Mex.

THEORY OF THE PINCH EFFECT. William P. Allis. Sept. 1953. Decl. Nov. 4, 1958. 14p. Contract W-7405-Eng-36. $3.30(ph OTS); $2.40(mf OTS).

Five Langmuir-Tonks equations given in Section V of LA-1432 were modified to give a clearer picture of the pinch effect. (W.L.H.)

1213 LA-2148

Los Alamos Scientific Lab., N. Mex.

A PROPOSAL FOR REDUCING IMPURITIES IN A STABILIZED PINCHED DISCHARGE. Ralph H. Lovberg. July 31, 1957. Decl. Nov. 5, 1958. 13p. Contract W-7405-Eng-36. $3.30(ph OTS); $2.40(mf OTS).

It is proposed to reduce the initial wall hangup and consequent plasma contamination of a stabilized pinched discharge by reducing the B_z pressure difference across the current sheath to nearly zero at early times. Two methods for accomplishing this are proposed, both involving multistage programming of the B_z system. (auth)

1214 NYO-993

Princeton Univ., N. J. Forrestal Research Center.

A PROPOSED STELLARATOR. Lyman Spitzer, Jr. July 23, 1951. Decl. Aug. 22, 1958. 17p. $3.30(ph OTS); $2.40(mf OTS).

The possible performance of a device designed to obtain power from the thermonuclear reactions between deuterium and either deuterium or tritium is analyzed. It appears from this theoretical study that a steady-state generator or "Stellarator" may be feasible. Such a thermonuclear reactor would find important uses both as a power source and as a neutron generator. (auth)

1215 NYO-995

Princeton Univ., N. J. Project Matterhorn.

PARTICLE ORBITS IN A LOW-DENSITY STELLARATOR. Lyman Spitzer, Jr. Oct. 1, 1951. Decl. Oct. 20, 1958. 56p. Contract AT(30-1)-1238. (PM-S-3). $9.30(ph OTS); $3.60(mf OTS).

A preliminary theoretical analysis is made of the ion and electron orbits to be expected in the Stellarator, on the assumption that the magnetic fields produced in the plasma are negligible, and that the plasma is quiescent. Neglect of the secondary magnetic field is valid only if the material energy density is very small compared to the magnetic energy density. The analysis indicates that in this situation ions and electrons at a kinetic temperature of some 10^8 degrees K will, on the average, stay within the Stellarator for more than a second, provided that the plasma space charge provides a radial electrical field of about 1000 to 10,000 volts per cm to produce rotation about the tube axis. Non-radial space charges will be kept small by currents along the lines of force around the Stellarator. A large fraction of the 3.5 Mev recoil α particles resulting from the D-T reaction can probably be retained in the tube for a second or more. The uniformity and symmetry required for the magnetic field should be readily obtainable. At the higher densities required for effective generation of power and neutrons the secondary magnetic field produced by the horizontal currents is comparable with the primary field. While no detailed analysis has been carried through for this situation, a brief examination does not reveal any insuperable obstacle to successful performance of the Stellarator. (auth)

1216 NYO-997
Princeton Univ., N. J. Project Matterhorn.
MAGNETIC FIELDS AND PARTICLE ORBITS IN A HIGH-DENSITY STELLARATOR. Lyman Spitzer, Jr. Jan. 28, 1952. Decl. Aug. 22, 1958. 45p. (PM-S-4). \$7.80(ph OTS); \$3.30(mf OTS).

The conditions for confinement of a plasma by a magnetic field have been investigated. In the case of a Type A toroidal magnetic field, with circular lines of force centered at the axis of symmetry, it is shown that confinement of the plasma by a magnetic field alone is impossible; other forces, comparable in magnitude with that produced by the pressure gradient, are required for equilibrium in a Type A torus. Difficulties associated with other types of toroidal fields are briefly discussed. (auth)

1217 NYO-2192
Princeton Univ., N. J. Project Matterhorn.
QUARTERLY REPORT COVERING THE PERIOD OCTOBER 1—DECEMBER 31, 1957. Decl. Oct. 20, 1958. 46p. Contract AT(30-1)-1238. (PM-Q-1). \$7.80(ph OTS); \$3.30(mf OTS).

The chief effort underway is the design of the Model C stellarator, a device some four times bigger than the B models. Heating at ion cyclotron resonance is being investigated with the existing B models; this technique offers some promise of achieving temperatures substantially in excess of 10^6 degrees in these smaller devices. The B-3 and Etude stellarators were nearing experimental operation, operation began with B-65, and and fabrication began on B-66. The B-1 stellarator was the only device in full and satisfactory operation. (D.E.B.)

1218 NYO-2193
Princeton Univ., N. J. Project Matterhorn.
QUARTERLY REPORT COVERING THE PERIOD JANUARY 1—MARCH 31, 1958. Decl. Oct. 20, 1958. 46p. Contract AT(30-1)-1238. (PM-Q-2). \$7.80(ph OTS); \$3.30(mf OTS).

A major effort was directed toward the preparation of papers and exhibits for the Geneva Conference. The experimental program was continued with the operation of Model B-3. The operation of Models B-1 and B-65 were continued. Additional information was gathered on the complex physical conditions occurring in ionized gases at high temperatures. Experiments on ion cyclotron resonance heating in the B-65 indicate about half the energy fed into the coil is absorbed by the gas at low power. The design of most of the components for Model C was completed. (For preceding period see NYO-2192.) (D.E.B.)

1219 NYO-2194
Princeton Univ., N. J. Project Matterhorn.
QUARTERLY REPORT COVERING THE PERIOD APRIL 1—JUNE 30, 1958. Decl. Aug. 20, 1958. 42p. Contract AT(30-1)-1238. (PM-Q-3). \$6.30(ph OTS); \$3.00(mf OTS).

Equipment for the Geneva Conference was completed and tested, and installation at Geneva was started. Extensive data on hydrogen discharges in the B-3 stellarator indicate the rate of diffusion across a magnetic field, during ohmic heating, varies inversely as the square root of the confining field. The mechanism for this diffusion, which produces "pump-out" of the initial gas, is not yet understood. Analyses of data from B-1 and B-3 provided further information on the complex phenomena that occur during ohmic heating. Measurements of ion cyclotron resonance heating in B-65 confirmed earlier data on energy absorption by gas, but information on high-power heating is not yet available. Model C detail design was continued, and component procurement was initiated. (For preceding period see NYO-2193.) (D.E.B.)

1220 NYO-3719
Princeton Univ., N. J. Project Matterhorn.
PLASMA CURRENTS IN THE A-2 STELLARATOR. Technical Memorandum No. 7. Martin Schwarzschild. Feb. 2, 1953. Decl. Oct. 20, 1958. 7p. Contract AT(30-1)-1238. \$1.80(ph OTS); \$1.80(mf OTS).

The currents reported are those induced in the plasma by the 250 kc voltage fed into the accelerating winding. All measurements were made with a ferrite ring which was placed such that both, the plasma current and the current in the aquadag (if any) went through the ring whereas the accelerating winding went around the ring. Hundred turns were wound on the ferrite ring so that the measurements gave directly one hundredth of the plasma current. (auth)

1221 NYO-6042
Princeton Univ., N. J. Project Matterhorn.
PRELIMINARY EXPERIMENTAL RESULTS WITH THE MODEL A STELLARATOR. Leonard M. Goldman and Lyman Spitzer, Jr. May 27, 1953. Decl. Oct. 20, 1958. 32p. Contract AT(30-1)-1238. (PM-S-9). \$6.30(ph OTS); \$3.00(mf OTS).

Experimental data on discharges are presented for the Model A stellarator, a pilot model designed to test whether confinement and heating of a plasma in a figure-8 tube is sufficiently promising to warrant construction of a more elaborate model, whose purpose would be to test confinement under conditions of interest for thermonuclear reactors. Confinement in Model A is produced by a magnetic field of strength up to 1500 gauss. Electrical breakdown of the gas is produced by a high-frequency a-c electrical field of about 0.4 volt/cm. The discharges behave in rough agreement with theoretical expectations, provided that the diffusion to the wall produced by plasma oscillations is taken into account. Moreover, the magnetic field needed to produce confinement in the figure-8 is an order of magnitude less than needed in a race track, or torus. For air at a pressure of 4×10^{-5} mm of Hg and a magnetic field of 500 gauss, the discharge ionizes about one-fifth of the molecules near the center of the tube. Under these conditions the level of ionization is limited primarily by the a-c circuit rather than by the random plasma oscillations. (auth)

1222 NYO-6044
Princeton Univ., N. J. Project Matterhorn.
DESIGN OF CORRECTION COILS FOR THE MODEL B STELLARATOR. Martin D. Kruskal. Jan. 1954. Decl. Oct. 20, 1958. 16p. (PM-S-11). $3.30(ph OTS); $2.40(mf OTS).

Portholes and flanges of the Model B stellarator obstruct the normal solenoidal windings which produce the confining field. Computations leading to the design of appropriate correction coils are described. The deviation from normal of the corrected field along the axis of the stellarator would be less than 2.6% if the stellarator were stretched out into a straight tube. Several estimates are given of the effect of the correction coils on parts of the stellarator which are near them due to its actually twisted shape, indicating that the actual maximum deviation from normal of the corrected field along the axis is about 3 or 3.5%. Finally, the energy storage of the normal and correction coils is discussed. (auth)

1223 NYO-6045
Princeton Univ., N. J. Project Matterhorn.
LARGE-SCALE PLASMA INSTABILITY IN THE STELLARATOR. Martin D. Kruskal. Apr. 1954. Decl. Oct. 20, 1958. 25p. (PM-S-12). $4.80(ph OTS); $2.70 (mf OTS).

In the presence of a large uniform longitudinal magnetic field, an infinite cylinder of ionized gas confined by a circumferential magnetic field is highly unstable with respect to lateral displacement of the plasma column into a helix of large pitch. The situation is representative of conditions in the Stellarator during pulse heating, if the effects of external coaxial conductors are included and if a periodicity condition is imposed to simulate the closure of the Stellarator tube. It is shown that the external conductors have negligible effect, but that due to the periodicity condition the instability cannot occur if the ratio of the plasma current to the confining magnetic field is less than a given critical value which depends only on the geometry of the Stellarator. (auth)

1224 NYO-6359
Princeton Univ., N. J. Project Matterhorn.
ELECTRIC FIELDS IN THE STELLARATOR. Lyman Spitzer, Jr. June 4, 1954. Decl. Oct. 20, 1958. 5p. $1.80(ph OTS); $1.80(mf OTS).

Equations for the equilibrium potential in a stellarator are developed. These equations indicate the steady electrostatic fields are not large. (D.E.B.)

1225 NYO-6372
Princeton Univ., N. J.
THE PROPOSED MODEL C STELLARATOR. Technical Memorandum No. 15. Robert G. Mills. May 4, 1955. Decl. Aug. 22, 1958. 18p. $3.30(ph OTS); $2.40(mf OTS).

The design problems of the proposed model C Stellarator including system design, magnet coils and power supply, gas heating equipment, vacuum system, and structures are discussed. A brief introduction and proposed schedule of operations are given. (W.D.M.)

1226 NYO-7308
Princeton Univ., N. J. Project Matterhorn.
MAGNETIC FIELD DESIGN FOR STELLARATOR SCALLOPS. Harold Koenig. Mar. 26, 1956. Decl. Oct. 20, 1958. 49p. Contract AT(30-1)-1238. (PM-S-18). $9.30(ph OTS); $3.60(mf OTS).

Sections of alternating curvature and field strength, called "scallops," have been proposed for the stellarator, to reduce the field distortion produced by plasma currents along the lines of force and then to permit operation at higher β (ratio of gas pressure to magnetic pressure). The design of such scallops is analyzed. The field strength inside a system of circular coils is determined graphically, by adding up the scalar magnetic potential associated with each coil. Two possible configurations are found. In both of these, straight sections, of length l_s, are required between the sections of positive curvature, strong field and of negative curvature, weak field. In one of these, Case II, l_s is 0.4 r_0, where r_0 is the radius of curvature of the magnetic axis in one of the curved sections; in the other, Case I, l_s is 0.2 r_0. In Case II the displacement of the magnetic axis, found from a first-order theory in β, is only $\rho\beta$, where ρ is the average tube diameter. It is concluded that within the framework of the present equilibrium theory such a system of scallops would perform satisfactorily the purpose for which it is intended, and permit operation at β of 0.5 or more. (auth)

1227 NYO-7309
Princeton Univ., N. J. Project Matterhorn.
A CONCEPTUAL DESIGN OF THE MODEL C STELLARATOR. W. R. Farber, J. C. Fraser, D. J. Grove, R. G. Mills, M. Rashevsky, M. A. Schultz, and L. Spitzer, Jr. Feb. 1, 1956. Decl. Oct. 20, 1958. 572p. Contract AT(30-1)-1238. (PM-S-19). $7.00 (OTS).

Consideration is given to the design of a new stellarator intermediate in size between the present B models and a full-scale power reactor. This new machine, designated model C, is conceived as an experimental tool having as much flexibility as feasible. With such a device it should be possible to extend considerably the knowledge of plasma physics under the conditions appropriate to a full-scale reactor. The first chapters are directed to a determination of the over-all requirements and the choice of size. There follows a complete conceptual design of the entire installation with engineering analyses and preliminary engineering design. With the exception of a few items as noted in the summary this report is complete in sufficient detail to serve as a basis for the detailed engineering required to produce working drawings. Model C is a pulsed stellarator capable of simulating steady-state operation, with a vacuum tube 9 inches in diameter in the characteristic figure-eight configuration, and measuring about 150 ft along the axis. The confining magnetic field is supplied by external coils requiring 150,000 kw peak of pulsed power. Ionization and heating of the gas are obtained by the application of externally applied electromagnetic fields. (auth)

1228 NYO-7310
Princeton Univ., N. J. Project Matterhorn.
CONFINING IONIZED PLASMA WITH HELICAL MAGNETIC FIELDS. Harold R. Koenig. May 25, 1956. Decl. Oct. 20, 1958. 78p. (PM-S-20). $12.30(ph OTS); $4.50(mf OTS).

The derivation of the H-transform and its rotational properties, magnetic distortion surfaces and the relation between distortion and limiting values of β confinement, analysis for properly including straight sections in helical machines, and methods of generating the primary field are discussed in a study on confining an ionized plasma with helical magnetic fields. (J.E.D.)

1229 NYO-7311
Princeton Univ., N. J. Project Matterhorn.
ON THE OHMIC HEATING OF A HELIUM PLASMA.
J. M. Berger and L. M. Goldman. June 20, 1956. Decl. Oct. 20, 1958. 39p. (PM-S-21). $6.30(ph OTS); $3.00 (mf OTS).

More refined calculations on the heating of a helium plasma, when subjected to a constant, uniform electrical field, have been performed on the N.Y.U. UNIVAC. Various cases of experimental and theoretical interest have been examined. The agreement with experimental results obtained from the Model B-1 stellarator varies with the experimental conditions. (auth)

1230 NYO-7312
[Princeton Univ., N. J. Project Matterhorn.]
ON THE OHMIC HEATING OF A HYDROGEN PLASMA.
J. M. Berger. July 2, 1956. Decl. Oct. 20, 1958. 23p. (PM-S-22). $4.80(ph OTS); $2.70(mf OTS).

Calculations on the formation and heating of a hydrogen plasma, when a constant electrical field is applied, have been made with the aid of the N.Y.U. UNIVAC. Various cases were treated to determine the expected performance under typical experimental conditions, the minimum field required for a sustained discharge, and the sensitivity of the calculations to uncertainties in the cross sections for the various atomic processes involved. The results are given graphically and indicate that successful operation with hydrogen may be expected for fields exceeding about 2.6×10^{-4} electrostatic volts per cm for a final density of 2.4×10^{13} protons/cc. Also indicated is that the uncertainties in the cross sections result in considerable uncertainties in the time scales for the discharges. (auth)

1231 NYO-7316
Princeton Univ., N. J. Project Matterhorn.
THEORY OF CONFINEMENT IN THE STELLARATOR.
Lyman Spitzer, Jr. Feb. 13, 1957. Decl. Oct. 20, 1958. 48p. (PM-S-26). $7.80(ph OTS); $3.30(mf OTS).

The fundamental element of any thermonuclear reactor is the magnetic field configuration used to confine the plasma. The principles of confinement by magnetic fields produced by external coils are analyzed and applied to an infinite cylinder, a simple torus, and the figure "8" of the Princeton Stellarator. (D.E.B.)

1232 NYO-7901
[Princeton Univ., N. J. Project Matterhorn.]
HYDROGEN DISCHARGES IN THE MODEL B-1 STELLARATOR. W. Bernstein, M. A. Heald, and A. Z. Kranz. Nov. 26, 1957. Decl. Oct. 20, 1958. 54p. (PM-S-31). $7.80(ph OTS); $3.30(mf OTS).

Hydrogen and deuterium discharges were studied in the baked B-1 Stellarator. The hydrogen and deuterium discharges were indistinguishable, within experimental error. In general, they were similar to the previously studied helium discharges. Data are presented for the plasma diagnostic information obtained. These include current, voltage, temperature, electron density, x rays, and light as functions of r-f pre-excitation, accelerating electric field, confining magnetic field, and gas pressure. (auth)

1233 NYO-7902
Princeton Univ., N. J. Project Matterhorn.
RESONANCE HEATING OF IONS IN A STRONG MAGNETIC FIELD. (INDIVIDUAL PARTICLE TREATMENT). Andrew Lenard and Russell Kulsrud. Feb. 5, 1958. Decl. Oct. 20, 1958. 35p. Contract AT(30-1)-1238. (PM-S-32). $4.80(ph OTS); $2.70(mf OTS).

A cylindrical, completely ionized, gas column is considered in a strong axial magnetic field oscillating near the ionic Larmor frequency. Individual ion orbits are computed, and from this, approximate expressions for the ion current and the energy absorption of the system are constructed. The resulting relation between ion current and electric field is used to solve Maxwell's equations in the plasma. Electrons are supposed to be tied to magnetic field lines, and serve merely to neutralize ionic space charge variations. It is shown that if a critical density is exceeded the accelerating electric field is strongly reduced from its vacuum value inside the plasma. Finally, conditions are discussed under which the approximations made are applicable. (auth)

1234 NYO-7968
New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
SHERWOOD PROGRESS REPORT NO. 1. Harold Grad. Oct. 1, 1957. Decl. Nov. 7, 1958. 24p. Contract AT(30-1)-1480. $4.80(ph OTS); $2.70(mf OTS).

A coordinated effect was made to develop the basic mathematical theory of plasma physics and magnetohydrodynamics with an eye to its ultimate use in the quantitative analysis of thermonuclear plasmas. Some studies undertaken relative to the Sherwood problems concern the theory of nonlinear partial differential equations (including gas dynamics), variational analysis, asymptotic theory of ordinary differential equations, numerical analysis, electromagnetics, and kinetic theory. Contributions have been made and are under way in the general theory of fluid magnetics, especially in the fields of nonlinear wave motion and equilibrium and in questions of stability (linear and nonlinear); to the theory of particle motion in electromagnetic fields, including adiabatic and nonadiabatic theories and also self-consistent field problems; to the theory of the Boltzmann equation including the deviation of generalized fluid models, the theory of shock waves, and evaluation of transport coefficients; also to questions of particle losses. (W.D.M.)

1235 NYO-7969
New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
THEORY OF CUSPED GEOMETRIES. I. GENERAL SURVEY. Harold Grad. Dec. 1, 1957. Decl. Nov. 7, 1958. 49p. Contract AT(30-1)-1480. $7.80(ph OTS); $3.30(mf OTS).

A survey of and introduction to some of the more important theoretical aspects of those cusped geometries which may be feasible as thermonuclear devices are presented. The basis for these investigations is an idealized plasma-field configuration of a free boundary surface or interface separating a plasma domain in which there is no electromagnetic field from a vacuum domain in which there is no plasma. (M.H.R.)

1236 NYO-8050
Princeton Univ., N. J. Project Matterhorn.
NON-LINEAR ELECTRON OSCILLATIONS IN A COLD PLASMA. John M. Dawson. Aug. 1, 1958. 23p. Contract AT(30-1)-1238. (PM-S-36). $0.75(OTS).

Investigations of non-linear electron oscillations in a cold plasma where the thermal motions may be neglected indicate that except for the simplest one dimensional situation such oscillations will destroy themselves through the development of multi stream flow. It is found possible to give an exact analysis of oscillation with plane, cylindrical, and spherical symmetry. Plane oscillations in a uniform plasma are found to be stable below a critical amplitude. For larger amplitudes it is found that multi stream flow or fine scale mixing sets in on the first oscillation. Oscillations with spherical or cylindrical symmetry develop multi stream flow almost always, independent of the amplitude. The time required for mixing to start is inversely proportional to the square of the amplitude. Plane oscillations in a non-uniform plasma are also found to exhibit this type of behavior. Some considerations are also given to more general oscillations and a calculation is presented which indicates that multi stream flow will usually set in. (auth)

1237 ORNL-2219
Oak Ridge National Lab., Tenn.
IONIZATION AND DISSOCIATION OF ENERGETIC IONS BY A CARBON DISCHARGE—STATUS REPORT. John S. Luce. Jan. 1957. Decl. Nov. 7, 1958. 24p. Contract W-7405-eng-26. $4.80(ph OTS); $2.70(mf OTS).

Carbon discharges have been operated continuously in a magnetic field at pressures of approximately 10^{-5} mm. Spectrographic analyses show the ions to be predominately C^{2+}. No trace of excited carbon neutrals can be observed; it is assumed that the carbon is essentially completely ionized. Ionization is measured ($N^+ \rightarrow N^{2+} + e$) when a 24-kv N^+ beam is passed through the discharge. Forty per cent of a 27-kv D_2^+ beam is dissociated ($D_2^+ \rightarrow D^+ + D^0$) without any measurable losses when passed through the discharge. Electrical and calorimetric measurements of the resultant beams (D^+ and D^0) were made. Characteristics of the trapped half-radius atomic beam were studied briefly. Application of this discharge to accelerators is mentioned. (auth)

1238 ORNL-2581
Oak Ridge National Lab., Tenn.
THE EFFECT OF PARTIALLY IONIZED IMPURITIES ON A DCX DEVICE. R. G. Alsmiller, Jr. Oct. 29, 1958. 21p. Contract W-7405-eng-26. $0.75(OTS).

A simple model of DCX is used to calculate the steady-state deuteron and electron temperatures when partially ionized impurities are present. The impurity considered is triply ionized carbon, i.e., C^{IV}, which has an excited state of 8 ev and an ionization energy of 64.5 ev. The calculations indicate that for an injection energy of 300 kev an average deuteron energy of the order of 250 kev will be obtained if the impurity input current is not greater than the deuteron input current. An alternate calculation using the same excited state but assuming ionization impossible gives an average deuteron energy of the order of 8 kev if the impurity current is not greater than the deuteron input current. (auth)

1239 UCRL-5285
California. Univ., Livermore. Radiation Lab.
REVIEW OF HOT-CATHODE ION SOURCE DEVELOPMENT FOR THE PULSED MAGNETIC MIRROR THERMONUCLEAR REACTOR PROGRAM. John A. Fasolo. July 9, 1958. 32p. Contract W-7405-eng-48. $1.00 (OTS).

A hot-cathode ion source for possible application to pulsed magnetic mirror machines was developed which produces several amperes of 10-kev ions on a pulsed basis. Ions are extracted radially, from a deuterium arc, across a magnetic field of several kilogauss. The current density for a 2.0 amp beam current is 3.4 amps/in.^{2} of extractor aperture. The operation of the source is described. (W.D.M.)

1240 UCRL-5286
California. Univ., Livermore. Radiation Lab.
CYCLOTRON RESONANCE HEATING OF A PLASMA IN A MAGNETIC "MIRROR." E. S. Chambers, A. A. Garren, D. O. Kippenhan, W. A. S. Lamb, and R. J. Riddell, Jr. June 17, 1958. 30p. Contract W-7405-eng-48. $1.00(OTS).

Heating of ions in a deuterium plasma by a radiofrequency electromagnetic field was studied theoretically and experimentally. A time-varying magnetic field, superimposed on the axis of a static magnetic "mirror" field, will induce an alternating azimuthal electric field. Such a field can accelerate ions and at the ion cyclotron resonance point can repeatedly increase their energy each cycle. An analysis of the individual particle motions is presented along with the estimated limitation of density by ionic diamagnetism and electron motions. Experiments were performed in which the alternating field was produced by the coil of a radiofrequency resonant circuit, and an increase in light intensity from the plasma was found at the ion cyclotron resonance point. In other experiments using an alternating electric field from a parallel rod the energy absorbed from this field increased at resonance. Charge exchange probably limited the ion energy to the order of 100 ev at the experiment pressure of 10^{-4} mm Hg, however by using improved conditions, such as lower pressure and higher fields, it should be possible to reach considerably higher ion energies. (auth)

1241
WILL FUSION BE INDUSTRIALLY FEASIBLE? G. Vendryes (C.E.A., Saclay, France). J. Phys. radium 19, 724-31(1958) Aug.-Sept. (In French)

The basic principles underlying the possible use of fusion for power production are developed. The prospects offered by the pinch effect are discussed in some detail. (J.S.R.)

1242
OBSERVATIONS ON THE PLASMA PRODUCED IN A MAGNETIC MIRROR GEOMETRY. W. B. Johnson (Linde Co., Indianapolis). Phys. Rev. Letters 1, 333-5(1958) Nov. 1.

The field produced in this geometry has only axial and radial components. When the field is caused to change with time, the former will induce a current into the plasma such that a compression toward the axis will occur. The latter component will cause an expulsion of the gas in the longitudinal direction away from the coils and the region of high magnetic field. Thus if a plasma is accelerated by a rapidly changing field with the above characteristics, the result will be two plasma fronts approaching each other from opposite directions while simultaneously collapsing toward the axis. (W.D.M.)

1243
GENERATION OF MOVING STRIATIONS AT A GAS ANODE. J. R. M. Coulter, N. H. K. Armstrong, and K. G. Emeleus (Queen's Univ., Belfast). Physica 24, 828-30(1958) Oct.

Some new results are described showing how the form of positive column wave which appears as a moving striation can be generated by a growing relaxation oscillation of the equivalent of an anode spot. (auth)

1244
SOME NEW DEVELOPMENTS IN THE FIELD OF THERMONUCLEAR INVESTIGATIONS. F. Boeschoten. R C N Bull 2, 93-101(1958) Aug. (In Dutch)

A brief survey is presented of the investigations in the United States, England, and Russia on controlled thermonuclear reactions. (J.S.R.)

GEOLOGY AND MINERALOGY

1245

SHERWOODITE, A MIXED VANADIUM(IV)-VANADIUM(V) MINERAL FROM THE COLORADO PLATEAU. Mary E. Thompson, Carl H. Roach, and Robert Meyrowitz (U. S. Geological Survey, Washington). Am. Mineralogist 43, 749-55(1958) July-Aug.

Sherwoodite, a new vanadium mineral that has the probable formula $Ca_3V_8O_{22} \cdot 15H_2O$, has been found in small amounts in many vanadium—uranium mines on the Colorado Plateau. The new mineral occurs as dark blue-black holohedral tetragonal crystals bounded by {110} and {011}. The space group is I4/amd, (D_{4h}^{19}), $a_0 = 27.8 \pm 0.08$ A, $c_0 = 13.8 \pm 0.08$, A, $a:c = 1:0.4964$, cell contents 16 ($Ca_3V_8O_{22} \cdot 15H_2O$). Sherwoodite is uniaxial negative, $\omega = 1.765 \pm 0.003$, $\epsilon = 1.735 \pm 0.003$, dichroism strong, O green, E blue. The hardness is about 2. The measured specific gravity is 2.8 ± 0.1. The chemical analysis, in per cent, is as follows: CaO 13.2, MgO 0.5, V_2O_4 5.9, Al_2O_3 2.6, Fe_2O_3 0.8, V_2O_5 50.2, H_2O 23.1, insoluble 3.8, total 100.1. (auth)

1246

A NEW MINING PROSPECT IN MADAGASCAR. MONAZITE SANDS. Jean J. Lecoq. Mines Met. No. 10, 591-4(1957). (In French).

The monazite deposits situated in the region of Fort Dauphin are described. Indications are given of their origin and possible exploitation. The industrial uses of monazite are then reviewed. (tr-auth)

1247

THE PERMIAN-TRIASSIC SERIES OF MOUNT BESIMAUDA AND THE URANIFEROUS MINERALIZATION OF PEVERAGNO. Mario Mittempergher. pp. 3-59 in "Studi e ricerche della divisione geomineraria, Volume I, Parte I." Rome, Comitato Nazionale per le Ricerche Nucleari, 1958. 352p. (In Italian)

The results of the chemical, petrographical, and geochemical studies made on the lithologic series of Mount Besimauda (Maritime Alps) are reported. The uranium deposits of Rio Freddo, placed in the upper levels of the porphyric schists near the contact with the over-lying quartzites, were examined, and their mineralogical composition are described. The sedimentary and syngenetic origin of the uranium mineralizations are proved. (J.S.R.)

1248

THE URANIFEROUS ORE DEPOSITS OF VAL DAONE. (SOUTHWESTERN TRENTINO). Mario Mittempergher. pp. 147-62 in "Studi e ricerche della divisione geomineraria, Volume I, Parte I." Rome, Comitato Nazionale per le Ricerche Nucleari, 1958. 352p. (In Italian)

The ore deposits of Val Daone occur in Permian sandstones and consist of a great number of thin carbonious and uraniferous beds. They have been slightly metamorphosed by the thermal action of a nearby granodioritic body that intruded in alpine time. The results of geological, petrographical, mineralogical, and chemical researches lead to the conclusion that the mineralizations are of sedimentary origin, and that the partial neoformation of pitchblende and of some accompanying sulfides is due to diagenetic and successive metamorphic processes. The comparison with other uraniferous deposits occurring likewise in Permian sandstones shows the significance of the peculiar structures found in the ore deposits in question. (auth)

1249

THE URANIFEROUS ORE DEPOSITS OF VAL RENDENA. Mario Mittempergher. pp. 163-86 in "Studi e ricerche della divisione geomineraria, Volume I, Parte I." Rome, Comitato Nazionale per le Ricerche Nucleari, 1958. 352p. (In Italian)

The uraniferous ore deposits of Val Rendena (western Trentino) lies in sandstones of an essentially Permian age. The results of the petrographical and minerographical study of the mineralized specimens and the country rocks are discussed. The geochemical character of the associations of secondary uranium minerals of the zone of oxidation of the deposit is described. The enrichment in uranium is always linked to the presence of organic matter with which this element, probably, forms metallo-organic compounds. By the mechanical action caused by the alpine orogeny, some of the uranium has been mobilized and reprecipitated in the form of pitchblende, which is accompanied by pyrite, chalcopyrite, arseniopyrite, and galena. In conclusion, the hypothesis of a sedimentary and syngenetic origin of the deposit is put forward; this conclusion has also been largely confirmed by other authors. (auth)

1250

DISTRIBUTION OF SODIUM, POTASSIUM AND CALCIUM IN PERMIAN ARENITES AND IN ADJACENT URANIFERROUS MINERALIZATIONS. Gianantonio Falchi. pp. 327-45 in "Studi e ricerche della divisione geomineraria, Volume I, Parte I." Rome, Comitato Nazionale per le Ricerche Nucleari, 1958. 352p. (In Italian)

The content of sodium, potassium, and calcium in a series of samples of the Permian arenites of Val Rendena was determined in order to establish their variation and the probable relation to the microscopical character of these rocks and to the mineralizations that occur locally. The results of these investigations permit conclusions about the supposed magmatic origin of the ore solutions. The content in sodium, which is always very small and variable, has been found to be insignificant in this respect. On the contrary, the content in other alkalies shows a very clear difference between the red and the gray arenites that represent the two characteristic facies of the formation in question. With regard to the alkali content of sterile and mineralized samples belonging to the facies of gray arenites, no systematic difference could be detected, so that the whole facies appears to be, chemically, very homogeneous. Hence, it may be assumed that the uraniferous mineralizations did not change the original chemical composition of the rocks; consequently a magmatic origin of the ores has to be excluded. (auth)

1251

CONTRIBUTION TO THE KNOWLEDGE OF THE URANIUM ORE DEPOSITS OF PREIT (COTTIAN ALPS). Sergio Lorenzoni and Eleonora Zanettin. pp. 349-434 in "Studi e ricerche della divisione geomineraria, Volume I, Parte II." Rome, Comitato Nazionale per le Ricerche Nucleari, 1958. 452p. (In Italian)

After a short note on the geological character of the so called axial zone of the Cottian Alps, detailed description is given of the chemical and petrographical properties of the Permian and Permotriassic series of the Valle del Preit, where some important mineralizations of uranium have been found. The oldest formations are represented by slightly metamorphosed Permian schists which derive partly from clayey sediments with marly intercalations, partly from arenites originated by the weathering of various rocks, but mostly of porphyric ones. The very fine grained sediments were probably deposited in shallow water, while the coarser sediments are of continental origin. Above these latter, Permotriassic conglomerates (post-Hercynian transgression) and triassic quartzites (marine arenites) were laid down. The uraniferous mineralizations are found within both the marine and the terrigenous formations. At the contact of these two formations, the uranium minerals are concentrated in lenticular bodies of various size and are accompanied by proportional quantities of apatite, pyrite, and organic substances. It is concluded that the uranium minerals and the accompanying minerals are of praemetamorphic and syngenetic origin, having been deposited in shallow water under reducing conditions which were favorable to the formation of phosphorites. (auth)

1252

SOME RADIOACTIVE LAMPROPHYRIC DYKE ROCKS OF THE SESIA-LANZO COMPLEX. Luisa de Marco. pp. 499-526 in "Studi e ricerche della divisione geomineraria, Volume I, Parte II." Rome, Comitato per le Ricerche Nucleari, 1958. 452p. (In Italian)

A petrographical description and chemical analyses of some radioactive lamprophyric dyke rocks that occur in the gneisses of the so called metamorphic complex of Sesia-Lanzo are given. These lamprophyres are rich in biotite and pyroxene or amphibole, while their groundmass is formed by orthoclase. The chemical analyses show that the five lamprophyres are very poor in alumina, having otherwise a strong alcaline-potassic character. The microscopical study, integrated by the use of nuclear plates, shows that the radioactivity is bound to an unknown mineral that forms little rounded grains enclosed in the other constituents. (auth)

1253

PRELIMINARY OBSERVATIONS ON THE URANIUM MINERALIZATIONS OF THE TUFF FORMATION IN VALGANNA (VARESE). M. Govi, L. de Marco, and P. Baggio. pp. 653-72 in "Studi e ricerche della divisione geomineraria, Volume I, Parte II." Rome, Comitato Nazionale per le Ricerche Nucleari, 1958. 452p. (In Italian)

Preliminary reports are presented on the tuff formations in Valganna in the province of Varese which appear to be mineralized with uranium. The general structure of the formations is anticline, complicated by the presence of some faults. The stratigraphic sequence was determined. The mineralization appears to be of sedimentary origin. (J.S.R.)

1254

OBSERVATIONS ON A PALEOZOIC SERIES AND THE URANIUM MINERALIZATION OF CARNIA AND COMELICO. Corrado Friz. pp. 673-90 in "Studi e ricerche della divisione geomineraria, Volume I, Parte II." Rome, Comitato Nazionale per le Ricerche Nucleari, 1958. 452p. (In Italian)

The paleozoic series under review is part of the area occurring in central Carnia up to the lower Comelico (Venezia Euganea). The Permian formations, which were objects of radiometric prospecting by the C.N.R.N. because some carbon strata appear to be uranium mineralized, are discussed. The geologic outline of the area is given by the neo-carboniferous transgression on the Devonian calcareous deposits and, in a more limited way, on the Silurian formations and on the pre-Paleozoic quartzeous phyllites. Such formations represent the remains of the denudation of the Hercynian (Ertzgebirge) massif (Paleo-Carnic). The neo-Carboniferous consists mostly of argillo-schists containing quartz and mica and, in part, of grey limestone. It envelops in a net transgression the erosion foldings of the Silurian and Devonian ages. In the upper levels it comprises eruptive rock outflows (both basic and acid) accompanied by scoria deposits. The stratigraphic series continues on the level of the Permian red sandstones called "Val Gardena sandstones" which comprise in their lower layers a conglomerate facies with some elements sunk in a red arenaceous cement. The upper Permian with lagoon facies characterized by abundant gypsum intercalations is next. The mineralization is localized in the red sandstone layers (lower Permian) and is mostly connected with the pelitic facies of discolored sandstones. (auth)

1255

AN INTERESTING CASE OF NON-EQUILIBRIUM IN URANIUM ROCKS: ACCUMULATION OF RADIUM D IN VOLCANIC TUFFS AND ITS DETERMINATION. G. Alberti, C. Bettinali, and F. Salvetti. pp. 691-8 in "Studi e ricerche della divisione geomineraria, Volume I, Parte II." Rome, Comitato Nazionale per le Ricerche Nucleari, 1958. 452p. (In Italian)

An interesting occurrence of unsupported RaD(Pb^{210}) in volcanic tuffs, weakly mineralized with uranium, occurring at Canale Monterano (not very far from Rome, in northern Lazio), is reported. The variability of uranium content and of U/RaD ratio is shown on 140 representative samples of a drilling. Also analyses of some interesting strata with high uranium content, but poor in RaD, are reported. These strata overlie other ones with lower uranium content but highly enriched in RaD. Because of the low diffusibility of radon and of the low mobility of leachable lead in the tuffs, the phenomena are attributed to the decaying of radon, dissolved in the circulating waters. Furthermore an analytical quantitative radiochemical method for the determination of the radioactive leads is described; it is based on extraction by a chloroform solution of dithizone. A radiometric semiquantitative procedure, based on the absorption of beta rays from RaE in equilibrium with RaD, by a screen of 0,9 mm aluminum, is also decribed. (auth)

1256

BEHAVIOR AND DETERMINATION OF RaB, RaD, AND ThB IN NATURAL WATERS. G. Alberti, C. Bettinali, and F. Salvetti. pp. 699-706 in "Studi e ricerche della devisione geomineraria, Volume I, Parte II." Rome, Comitato Nazionale per le Ricerche Nucleari, 1958. 452p. (In Italian)

The conditions under which the natural radioactive isotopes of lead can be found in natural waters were examined, taking into account the possible behavior of the radiocolloids, and the chemical composition of the water. A simple radiochemical method of measuring Pb^{210}, Pb^{212}, and Pb^{214} is described, by the aid of which it is possible to establish quantitatively the radon content of natural waters. Using this method it is also possible to determine the Ra and Ra^{224} that may be present. The conditions are discussed under which it is possible to relate the content of radioactive lead in the water to that of U and of Th and to the emissive power of the rock from which the water issues. (auth)

1257
DISTRIBUTION OF RADIOACTIVITY IN SYENITE FROM BIELLA. S. Deutsch and A. Longinelli. pp. 711-24 in "Studi e ricerche della divisione geomineraria, Volume I, Parte II." Rome, Comitato Nazionale per le Ricerche Nucleari, 1958. 452p. (In Italian)

Some thin sections of syenite from Biella were studied by means of 50 μ thick Ilford C 2 nuclear plates. It was possible to determine the specific activity of the following essential minerals, here listed in order of frequency: orthose, anfibole, plagioclase (here found in fairly alkaline types of the andesine group), biotite, quartz, pyroxene, and of the following accessories, also listed in order of frequency: apatite, titanite and zircon. A fairly active mineral of a golden yellow color, with a high refraction index and partially metamictic, was also found. This negative uniaxial mineral has in its non-metamictic parts very low double-refraction and is nearly always included in the anfibole which, at the point of contact, is found to be highly transformed by the activity of the inclusion. It was suggested that this mineral, because of its optical characteristics, may belong to the fergusonite group. Very occasionally small crystals of uraninite are also present. The specific activity of the essential minerals was calculated as "real activity" and "total activity" (that is including that of the inclusions). For each component of the rock, the U content in the hypothesis Th/U = 3 was calculated. This calculation was made on the basis of the α activity. The activity of the boundaries between crystals is less than 1%; as in other rocks, above 80% of the activity is due to the accessories. Data relative to other igneous rocks are given in order to compare them with the data for syenite from Biella. In spite of the limited number of rocks studied to date, one can see a tendency towards the lowering of specific activity of single minerals with a decrease in the acidity of the rock. (auth)

1258
THE AGE OF URANIUM MINERALS IN THE WESTERN ALPS. G. Ferrara (C.N.R.N. Laboratorio di geologia nucleare, Pisa, Italy); D. Ledent (Universite Libre, Brussels); and H. Stauffer (Univ. of Bern). pp. 725-37 in "Studi e ricerche della divisione geomineraria, Volume I, Parte II." Rome, Comitato Nazionale per le Ricerche Nucleari, 1958. (In Italian)

The age of some uranium-bearing mineralizations in the Western Alps was determined by the RaD method. According to the hypothesis advanced the uranium should have been bound in the sediments during or immediately after their deposition. The fixation of the uranium is linked to the transgression which interested the whole area of the Alpine arc during an interval of time between the upper Carboniferous and the middle Triassic. The environment favorable to the fixation of the uranium was that characterized by the formation of lagoons and of shallow seas in which sediments, rich in organic matter, were deposited. The fixation of the uranium dissolved in the solutions deriving from the weathering of the emerged parts seems to be due to the organic matter. The age of the mineralizations must, in this case, be identical to that of the including sediment, provided that no uranium losses have occurred during the Alpine metamorphism. The ratio Pb/U was calculated indirectly by the RaD method. The values so obtained were corrected by the isotopic analysis of the lead. As the content in thorium is less than 1/10000 that in uranium, the correction of Pb^{208} could be neglected. The age of the various samples oscillates around the medium value of 187 millions of years. Only one sample, which is surely of secondary origin, shows an age of only 97 millions of years. The average value confirms the hypothesis of the contemporaneity of the mineralization with the sedimentation that happened probably in young Permian time. On the other hand, the exceptionally low age of one sample indicates that in some cases secondary concentration was caused by the Alpine metamorphism. (auth)

1259
DIFFRACTOMETRIC EXAMINATION OF SOME ITALIAN SEDIMENTARY PITCHBLENDES. Carlo L. Garavelli. pp. 739-60 in "Studi e ricerche della divisione geomineraria, Volume I, Parte II." Rome, Comitato Nazionale per le Ricerche Nucleari, 1958. 452p. (In Italian)

Twelve samples of cryptocrystalline uraninite (pitchblende) from deposits in the Alps were studied. The origin of the samples is likely sedimentary. The interpretation of powder diagrams and the accurate determination of lattice parameters has shown that the chemical composition of these minerals is, in general, different from the stoichiometric formula UO_2, U^{+6} and an excess of oxygen atoms also being present. In a few samples a tetragonal phase is present. It was previously observed only as a product of artificial oxidation of UO_2. By heating the natural samples in a covered crucible, up to about 1000°C, a cubic phase is formed, the a_0 values of which depend upon the degree of the natural product oxidation; if the tetragonal phase, is present, the product of ignition is U_3O_8, together with greater amounts of UO_2 having $a_0 = 5{,}44$ Å. The geological implications of the structural features observed are also briefly examined, chiefly in regard to the diagenetic actions which are responsible of the transformation in crystalline U oxides of the metallo-organic compounds formed by adsorption of U sediments rich in organic matter. (auth)

1260
FIRST NATURAL OCCURRENCE OF ZEUNERITE FROM SECONDARY URANIUM MINERALS IN THE VAL RENDENA. Carlo L. Garavelli and Fiorenzo Mazzi. pp. 785-92 in "Studi e ricerche della divisione geomineraria, Volume I, Parte II." Rome, Comitato Nazionale per le Ricerche Nucleari, 1958. 452p. (In Italian)

The presence of zeunerite ($Cu(UO_2)_2(AsO_4)_2 \cdot 10$ to $16H_2O$) was established among the secondary U minerals of the deposit of Palastro (Val Rendena). This is the first natural occurrence of zeunerite, because the previous findings proved to be of the lower hydrate, metazeunerite. The Val Rendena mineral shows: $n_0 = 1.614$ (1.602 to 1.610 for the corresponding synthetic compound) and lattice periods $a_0 = 7.173$ A, $c_0 = 20.801$ A ($a_0 = 7.19$ A, $c_0 = 20.77$ A for the synthetic material). A spectrochemical analysis showed the presence of U, Cu, and As as principal constituents; Ca and P are also present in amounts less than 1%. (auth)

HEALTH AND SAFETY

1261 APAE-Memo-78(Rev.III)
Alco Products, Inc., Schenectady, N. Y.
HEALTH PHYSICS MANUAL FOR THE ARMY PACK-

AGE POWER REACTOR. B. M. Ball. Jan. 18, 1957. Rewritten Apr. 1, 1958 by B. James. Revised Sept. 30, 1958 by G. J. Vodspive. 13p. Contracts AT(11-1)-318 and AT(30-3)-326. $3.30(ph OTS); $2.40(mf OTS).

Radiation monitoring and safety procedures for the Army Package Power Reactor are outlined. (C.H.)

1262 BNL-3390
Brookhaven National Lab., Upton, N. Y.
THE RELIABILITY AND APPLICABILITY OF DIFFUSION ESTIMATES IN AIR POLLUTION PROBLEMS. Maynard E. Smith. [1957]. 15p. $3.30(ph OTS); $2.40 (mf OTS).

Presented at Semi-Annual Tech. Conf. of the APCA, San Francisco, Nov. 19, 1957.

Diffusion plays a very important role in most air pollution problems today, and estimates of atmospheric concentrations of waste gases and particulates are more and more frequently included in the design data. In the present paper, these estimates are reviewed from the point of view of their mathematical and physical limitations in order to determine their accuracy and applicability. The review suggests that much research must be completed before the diffusion problem can be relegated to standard engineering practice. However, even though many limitations exist, a number of the simpler diffusion problems can now be treated with an accuracy acceptable for engineering design. (auth)

1263 COO-212(Rev.)
Chicago Operations Office. Health and Safety Div., AEC.
HEALTH AND SAFETY CONSIDERATIONS FOR URANIUM FUEL FABRICATION FACILITIES. William A. Brobst. Aug. 1, 1958. 54p.

With the advent of the reactor power program, a large number of firms are becoming involved in the manufacture of reactor fuel elements. This publication has been prepared to insure that these firms are aware of the health and safety problems involved and to offer some solutions to these problems. The manual presents situations to be considered, lists pitfalls to be avoided, and states the minimum standards of the Chicago Operations Office regarding the handling of uranium. (auth)

1264 DMIC-Memo-2
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
SOME NOTES ON SAFE HANDLING PRACTICES FOR BERYLLIUM. Webster Hodge. Sept. 22, 1958. 14p.

Information based on limited literature references and observations of shop operations by DMIC personnel is presented. It is pointed out that no safe handling recommendations for a new facility can be made on the basis of available information; however, the references and descriptions may be useful as guide lines in shops where beryllium is being handled for the first time. Maximum allowable concentration is considered, along with methods of air sampling and hood systems for collection and disposal of dust. In addition, the experiences of several organizations which handle beryllium are reviewed. (J.R.D.)

1265 HASL-36
New York Operations Office. Health and Safety Lab., AEC.
HEALTH PROTECTION IN BERYLLIUM FACILITIES SUMMARY OF TEN YEARS OF EXPERIENCE. A. J. Breslin and W. B. Harris. May 1, 1958. 62p. $1.75 (OTS).

Beryllium materials have been manufactured and processed safely by USAEC contractors over a period of ten years at a variety of operations ranging from small experimental projects to large production plants. The application of basically conventional engineering controls to restrict airborne contamination and personal contact has successfully reduced injury to an acceptable level. The potential hazard increases with greater quantities of in-process material. In small-scale operations the hazard is usually confined to employees directly involved. At larger enterprises such as the beryllium refinery, neighborhood air contamination and stream contamination can present problems, although it should be noted that any present restriction of water concentration is based on administrative policy rather than on known hazard. The control criteria have been a set of recommendations issued in 1948 by the Beryllium Medical Advisory Committee to the AEC. This committee proposed air concentration maxima for occupational and neighborhood exposures. These values have been re-examined periodically and have remained essentially unaltered, although there has been some liberalization of interpretation to permit greater flexibility in larger plants so that reasonably uninterrupted production could be achieved. The liberalization has been based on the experience described in this report. Certain key factors in process design and operation common to both large and small operations are essential to satisfactory control. These include close attention to procedural details, restriction of manual process steps, careful application of local exhaust ventilation to most process steps, frequent air sampling to discover incipient control deficiencies, routine thorough housekeeping, and the candid indoctrination of employees to secure genuine cooperation. The importance of these control measures and the techniques of application are discussed along with pertinent exposure data. A comprehensive medical program is of basic importance. Preplacement screening and periodic re-examination are recommended for any operation of significant magnitude. Optimum design for the control of neighborhood air contamination has been achieved through the application of stack diffusion theory and careful choice of air cleaning equipment. Continuous offsite air sampling is used at larger installations to monitor the dispersion of stack effluents. Data are presented to demonstrate the degree to which the designs were successful in achieving the basic objective. (auth)

1266 HW-48523(Del.)
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
CONCENTRATION OF RADIOISOTOPES IN COLUMBIA RIVER WHITEFISH IN THE VICINITY OF THE HANFORD ATOMIC PRODUCTS OPERATION. D. G. Watson and J. J. Davis. Feb. 18, 1957. Decl. with deletions Oct. 27, 1958. 133p. Contract W-31-109-Eng-52.

Results of a study on the uptake of radioisotopes by Columbia River whitefish for the period from June 1950 to December 1956 are presented. Differences in concentrations of radioactive materials as related to geographical location, season, age, specific tissue, and concentration of reactor effluent in the river are discussed. Changes in concentration with cooking were determined. Maximum concentrations of P^{32} on the order of 2×10^{-4} $\mu c/g$ of flesh were recorded for sportfishing areas immediately upstream and downstream from the Hanford Atomic Products Reservation. Human consumption of whitefish flesh at the rate of 2.7 pounds per week from public fishing areas during the fall months would produce maximum permissible concentrations of P^{32}. (auth)

1267 NYO-4753(Suppl.3)
New York Operations Office, AEC.
ANNOTATED BIBLIOGRAPHY ON LONG RANGE EFFECTS OF FALLOUT FROM NUCLEAR EXPLOSIONS. Allen G. Hoard. Oct. 1958. 30p.

This bibliography is limited to published articles and speeches concerning the various aspects of radiation effects resulting from fall-out of nuclear explosions. The following cataloging and abstracting sources were checked: Nuclear Science Abstracts, Chemical Abstracts, Science Abstracts (Sect. A), Industrial Arts Index, and Monthly Catalog, U. S. Government Printing Office. This bibliography is arranged alphabetically by senior author of each article. When no author is available, the entry is arranged alphabetically by title. (auth)

1268 WT-1189
Federal Civil Defense Administration, Battle Creek, Mich. and Michigan. Univ., Ann Arbor. Engineering Research Inst.
DAMAGE TO COMMERCIAL AND INDUSTRIAL BUILDINGS EXPOSED TO NUCLEAR EFFECTS. Bruce G. Johnston. Feb. 1956. 107p. Project 31.2 [of] OPERATION TEAPOT. $2.50(OTS).

One equipment control building designed to be blast resistant and two each of three standardized types of metal warehouse or utility buildings were exposed to the effects of a nuclear device detonation. One of the utility buildings was frameless, with deeply corrugated wall and roof sections; a second was very largely frameless, utilizing interlocking channel sections; and in the third the aluminum-panel wall and roof covering was supported by girts and purlins, which in turn were supported by steel frames. Because of atmospheric conditions at the time of an earlier detonation in the test series, one of each of the three types of utility buildings was exposed to approximately 0.7 psi overpressure before the planned test. In the planned test one of each of the three types was exposed to approximately 3.0 psi overpressure and one to 1.3 psi, with the intention of bracketing their overpressure survival range and obtaining data for possible economic redesign for improved blast resistance. The equipment control building utilized continuous-welded steel frames and reinforced-gypsum curtain-wall construction. The control building was exposed to approximately 4.1 psi, in the anticipated fringe zone of major structural damage, to determine its protective capabilities. The blast-resistant equipment control building was not structurally damaged by the blast, thus exceeding the expectations of the design. Each of the three utility buildings received severe damage at the near range, one being completely destroyed, whereas at the far range the damage in every case was repairable. The test results are discussed, and recommendations for improved designs are made. Damage records during the unexpected test and at the far range in the planned test are correlated by means of dynamic analyses with pressure-time data and studies of structural resistance. Pressure-time information is appended. (auth)

1269 AEC-tr-3424
THE DANGERS FROM FALLOUT OF RADIOACTIVE STRONTIUM AFTER ATOMIC BOMB EXPLOSIONS. Eilif Dahl. Translated by O. J. Kleppa from Tek. Ukeblad (1957) Aug. 17p.

Recently there has been presented, particularly from American sources, a considerable amount of information for evaluation of the dangers from fallout of radioactive strontium after atomic bomb explosions. Some of the conclusions which have been drawn rest on a questionable statistical foundation. Also, there is reason to believe that more radioactive strontium will be taken up in the human organism than was believed previously. If one takes these things into account, one arrives at the conclusion that continued atomic bomb tests probably will endanger the health of considerable population groups. (auth)

1270 NP-tr-143
THE PROBLEM OF "CONTAMINATION" OF SOILS AND CROPS WITH THE PRODUCTS OF RADIOACTIVE FISSION. (A SURVEY OF THE PRINCIPAL LITERARY DATA). (Problema "Zarazheniia" Pochv i Sel' skokhoziastvennykh Posevov Produktami Radioactivnogo Raspada. (Obzor Glavneishikh Literaturnykh Dannykh)). Yu. A. Poliakov and N. S. Germogenova. Translated from Pochvovedenie No. 8, 57-73(1956). 35p.

A literature survey was made on the contamination of soils and crops by fission products. A summary of the findings is presented. 22 references. (C.H.)

1271
AN EXPERIMENTAL STUDY OF AEROSOL DEPOSITION IN HUMAN SUBJECTS. P. E. Morrow, E. Mehrhof, L. J. Casarett, and D. A. Morken (Univ. of Rochester, N. Y.). Arch. Ind. Health 18, 292-8(1958) Oct.

In 17 experiments on seven normal subjects seated at rest, the mean mass deposition of submicroscopic sodium chloride aerosol was found to be 63.4%, a value higher than that predictable using the commonly employed particle-size-deposition relations. The hygroscopic nature of the salt is not believed to satisfactorily explain this high value. The greater deposition of particles under 0.1μ diameter is probably as important a basis for the increased total deposition value as the hygroscopicity of such an aerosol. Several physiologic parameters capable of objective measurement appear to be related to mass deposition: specifically, the mean tidal volume, the respiratory frequency, and the mean respiratory air flow rates. Some of these relations have been reported by other investigators but not for subjects breathing naturally or with a heterogeneous submicronic dust. There appears to be no basis for selecting any one or more of the parameters studied as primary factors. 65 references. (auth)

1272
THE Sr^{90} CONTENT OF SOME SCHLESWIG-HOLSTEIN SOILS. Ernst Knoop and Diedrich Schroeder (Bundesforschungsanstalt fur Milchwirtschaft, Kiel and Univ. of Kiel). Naturwissenschaften 45, 436-7(1958)

As a determination of the Sr^{90} content of milk showed a large variation, a determination of the Sr^{90} of various types and varieties of soils in Schleswig-Holstein was made. The results showed that the Sr^{90} content varied by a factor of five. The activity increased from the Baltic Sea to the center of the region and then decreased toward the North Sea. This variation in the Sr^{90} content of the soil explained the large variation in the Sr content of milk. (J.S.R.)

1273
RADIOACTIVITY OF PEOPLE AND MILK: 1957. MEASUREMENTS OF 2200 SAMPLES FOR CESIUM-137 AND POTASSIUM-40 LEVELS REVEAL INTERESTING CORRELATIONS. Ernest C. Anderson (Los Alamos Scientific Lab., N. Mex.). Science 128, 882-6(1958) Oct. 17.

The routine determination of cesium-137 and potassium-40 content of over 2200 samples was accomplished through utilization of one-fifth of the potential capacity of the Los Alamos human counter. Little change in the cesium-137 concentration in people was observed from 1956 to 1957, in spite of the increase in both the rate and the integrated levels of fallout. The correlation of levels in human beings with cesium levels in milk indicates a discrimination factor of 1.8 in this step of the ecological transfer. Precipitation is shown to be an important factor determining the cesium content of milk, but the lack of complete correlation indicates that a more detailed analysis is necessary. Contamination of the troposphere during periods of weapon testing complicates the interpretation, as do seasonal variations. (auth)

1274

QUANTITATIVE TECHNIQUE FOR ANALYSIS OF RADIATION-INDUCED TUMORIZATION IN FERN PROTHALLI. Carl R. Partanen (Children's Medical Center, Boston and Harvard Univ., Cambridge, Mass.). Science 128, 1006-7(1958) Oct. 24.

Preliminary results are reported from an analysis of the process of tumorization in fern gametophytes, and especially its increased frequency of occurrence after exposure of dormant spores to ionizing radiations. (C.H.)

1275

BENEFICIATION OF SOILS CONTAMINATED WITH STRONTIUM-90: BENEFICIAL EFFECTS OF POTASSIUM. W. F. Libby (Carnegie Inst. of Washington). Science 128, 1134-5(1958) Nov. 7.

Recent data on the influence of soil type on the availability of radiostrontium to plants are reviewed. The possibility that treatment of heavily contaminated soil with ordinary fertilizers in reasonable amounts may have beneficial effects on radiostrontium uptake by plants was investigated. The addition of sulfate to soil did not prove to be an effective means of reducing radiostrontium pickup by crops grown on contaminated soils. Potassium, in amounts as low as 30 lb. per acre, effected about a 40 per cent reduction of radiostrontium uptake by plants. (C.H.)

1276

CONCENTRATIONS OF RADIOACTIVE MATERIALS IN THE AIR DURING 1957. Luther B. Lockhart, Jr. (U. S. Naval Research Lab., Washington). Science 128, 1139 (1958) Nov. 7.

Data are tabulated on the geographical distribution of atmospheric radioactivity during 1957. The bulk of the radioactivity is shown to be due to radon and its decay products, which result from radioactive decay of radium in the soil and the consequent diffusion of the gaseous radon daughter into the air. Radioactivity due to fission products amounted to only 1.2 per cent of the radon concentration. (C.H.)

1277

GENETIC AND SOMATIC EFFECTS OF CARBON-14. Linus Pauling (California Inst. of Tech., Pasadena). Science 128, 1183-6(1958) Nov. 14

On the basis of information about carbon-14 given by Libby, calculations are made of the predicted genetic and somatic effects of the carbon-14 produced by the testing of nuclear weapons. It is concluded that 1 year of testing (30 megatons of fission plus fusion) is expected to cause in the world (estimated future number of births per year 5 times the present number) an estimated total of about 55,000 children with gross physical or mental defects, 170,000 stillbirths and childhood deaths, and 425,000 embryonic and neonatal deaths. (There is an unknown amount of overlap of these three categories.) These numbers are about 17 times the numbers usually estimated as the probable effects of the fallout fission products from 1 year of testing. In addition, the somatic effects of bomb-test carbon-14 are expected to be about equal to those of fission products, including strontium-90, with respect to leukemia and bone cancer and greater than those of fission products with respect to diseases resulting from radiation damage to tissues other than bone tissue and bone marrow. All of the estimated numbers are subject to great uncertainty; they may be as much as 5 times too high or 5 times too low. The uncertainty in the estimation of the relative effects of carbon-14 and fission products in world-wide fallout is not so great. (auth)

INSTRUMENTS

1278 AECU-3853

Knolls Atomic Power Lab., Schenectady, N. Y.

OPERATIONAL PERFORMANCE OF MAGNETIC FLOWMETERS ON A SODIUM COOLED REACTOR. E. R. Gasser. [1957]. 17p. Contract [W-31-109-Eng-52]. (M-6221). $3.30(ph OTS); $2.40(mf OTS).

The design and operation of a magnetic flowmeter for use in estimating sodium flow in cooling channels are described. The flowmeter requires minimum maintenance and is reliable. It is pointed out that the magnets must b carefully calibrated, and the meter should be installed i a clean, easily accessible location. (J.R.D.)

1279 AECU-3869

Oak Ridge Gaseous Diffusion Plant, Tenn.

AUTOMATING THE MASS SPECTROMETER: A LITERATURE SEARCH. Alice S. Behr, comp. Dec. 9, 1957. 8p. (KLI-4270). $1.80(ph OTS); $1.80(mf OTS).

Most of the references concern automation of various components of the mass spectrometer rather than automation of the entire instrument. Line recorder references have been exluded in this search. The references are arranged chronologically within the Journal and Patent form headings. Report material is listed by primary report number within the issuing installation headings. (auth)

1280 AERE-C/M-356

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A REMOTELY OPERATED HILGER SPEKKER ABSORPTIOMETER FOR USE WITH RADIOACTIVE SOLUTIONS. G. P. Kitt and J. H. Moss. Aug. 1958. 14p. $0.45(BIS).

A remotely operated Hilger Spekker Absorptiometer Type H560 housed in a small analytical cell is described. The instrument is used for colorimetric analysis of beta- and gamma-active solutions. (auth)

1281 AERE-HP/R-2644

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

A NEUTRON MONITOR FOR ENERGIES ABOVE 20 MeV. P. D. Holt and A. B. Clare. Aug. 1958. 19p. $0.49 (BIS).

Details are presented of the carbon-11 scintillation threshold detector of neutrons, with a summary of the present performance. A polystyrene phosphor is irradiated in the neutron flux and carbon-11 is produced by the $C^{12}(n,2n)C^{11}$ reaction; the phosphor is then removed and the positron activity of the carbon-11 observed with a photomultiplier. The main problems are reduction of the background for the carbon-11 counting, determination of the carbon-11 counting efficiency and assessment of the statistical accuracy of the result. The threshold energy is 20.4 Mev; assuming that the maximum permissible flux of neutrons of energy greater than this is independent of the energy, then the carbon-11 activity will be approximately proportional to the tissue dose, up to at least 400 Mev. A flux of 10 neutrons/cm^2/sec (half the maximum permissible flux) may be measured with a statistical standard deviation of 10%, the total time required (including that for the background count) being 2 hours. (auth)

1282 CEA-744
France. Commissariat à l'Énergie Atomique, Paris.
ETUDE DE CHAMBRES A FISSION MINIATURES. (Miniature fission chambers). M. Guery and J. Tachon. Jan. 1958. 57p.

A general discussion is presented on fission chambers. The characteristics of an ideal fission chamber are given. Their efficiency is discussed, and the fission chambers being manufactured today are described. The fabrication techniques, the electrical properties, and measurements and perturbing factors of fission chambers are discussed. (J.S.R.)

1283 CEA-745
France. Commissariat à l'Énergie Atomique, Paris.
ETUDE DU PHÉNOMÈNE DE LA PULVÉRISATION CATHODIQUE A BASSE ÉNERGIE. (Study of the Phenomenon of Cathodic Pulverization at Low Energy.) J. Druaux. 1957. 41p.

Every time positive ions bombard the cathode of a discharge tube, a continuous destruction of the cathode and a corresponding deposit on the surrounding walls are observed. This phenomenon is known as "cathodic pulverization." It has been known for about a century, but the difficulties of observation and the numerous secondary phenomena which accompany it have for a long time held up the correct explanation of its physical mechanism. At the present time, it can be said that no theory can yet claim to make it completely intelligible. However, cathodic pulverization can be considered as a particular case of the phenomenon of collisions between atomic particles; in this instance it is a question of the impact of positive ions accelerated by U volts (I_u^+) on the atoms of a solid or liquid target X. (auth)

1284 CF-55-9-122
Oak Ridge National Lab., Tenn.
DETECTION AND TELEMETERING OF IONIZING RADIATION BY FREQUENCY VARIATION. Hans Kohn Richards. Sept. 30, 1955. 34p. Contract W-7405-eng-26. $6.30(ph OTS); $3.00(mf OTS).

Three methods are discussed for detecting ionizing radiation and transmitting the intelligence. All three methods make use of the reactance variation of a frequency determining network, to vary the frequency of an R.F. transmitter as a function of ionizing radiation entering an ion chamber or counter. The first method is based on the capacitance and subsequent frequency variation of an electrometer incorporated in an ion chamber. The variation is achieved by a moving vane electrometer, where the position of the vane changes as a function of the leakage of an electrostatic charge when exposed to radiation and thus varies the electrometer capacitance. Gamma, beta particles, and fast neutrons were measured during these experiments. The second method replaces the moving vane electrometer by ferroelectric capacitances. This reduces the sensitivity, but permits movement of the instrument during exposure. These ferroelectric capacitances are physically very small and can be enclosed inside of an ion chamber. The variation of the capacitance with charge or voltage permits measurement of the ionization current as a function of capacitance and frequency. The third and most successful method replaces the ion chamber by a Geiger counter, single pulses and integrated pulse rates can be measured and transmitted. (auth)

1285 CNI-4
Italy. Comitato Nazionale per le Ricerche Nucleari, Milan.
IMPULSI DI NEUTRONI PRODOTTI DA UNA FENDITURA RUOTANTE. (Neutron Pulse Produced by a Rotating Slit.) C. Coceva. Sept. 15, 1958. 28p.

The object of this report is to find the shape of the bursts of neutrons produced by a mechanical chopper. The problem is solved for a symmetrical slit with a shape general enough for practical purposes. A numerical example is carried out in order to show the use of the formulas which were found. Some questions concerning the neutrons transmitted and the resolution of a time-of-flight spectrometer are briefly examined. (auth)

1286 DP-287
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
MEASUREMENT OF LOW VELOCITIES IN LIQUIDS. H. Elwyn Wingo, Jr. June 1958. 21p. Contract AT(07-2)-1. $0.75(OTS).

An instrument was developed to measure the magnitude and direction of liquid velocities between 0.1 and 5 ft/sec. The detecting element consisted of two electrically heated thermistors in a small enclosure whose major axis could be oriented in any direction. The orientation that produced the maximum flow through the enclosure, as indicated by the thermistor signal, determined the direction and sense of the velocity vector. The instrument was designed for study of the nonuniform, three-dimensional flow of filtered water in a partially baffled tank. (auth)

1287 DP-302
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
AN ALPHA MONITOR FOR PROCESS STREAMS. William L. Pillinger. July 1958. 17p. Contract AT(07-2)-1. $0.50(OTS).

A scintillation counter was developed that measures alpha activity in a process stream. The instrument was demonstrated with plutonium solutions that ranged in activity from 10^3 to 10^7 d/m-ml. Plutonium concentration could be determined to ± 10% when the monitor was operated within a span of three decades or less. (auth)

1288 DTMB-1257
David Taylor Model Basin. Applied Mathematics Lab., Carderock, Md.
SURVEY OF ANALOG-TO-DIGITAL CONVERTERS. Sidney Lechter. Sept. 1958. 149p.

Based on the results of a survey, the specifications of the latest analog-to-digital converters are given. These specifications emphasize the input, output, and physical characteristics. Typical applications are also given. Comparative tables and a bibliography are included. (auth)

1289 GAT-254

Goodyear Atomic Corp., Portsmouth, Ohio.
MONITORING OF MATERIAL OF LOW U-235 ASSAY THROUGH GAMMA RADIATION ENERGY SEPARATION. M. E. Jacobs. Oct. 13, 1958. 28p. $4.80(ph OTS); $2.70(mf OTS).

The isotopes of uranium and their daughter products emit gamma radiation which is characteristic of each of the radioactive isotopes in the absence of the others. This radiation can be detected with a gamma counter, and is separated into a spectrum according to the different energies. The count rate indicated by the detector can be correlated to the uranium-235 assay of a uranium sample when the equipment is calibrated to count the characteristic radiations of this isotope. This procedure can be used to monitor liquid uranium hexafluoride samples of low assay. In the range from 0.2% to 1% assay, the count rate-vs. -assay curve is linear. (auth)

1290 HW-50355

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
INFORMATION FOR THE APPLICATION OF DUAL-FILTER PHOTOMETERS FOR CONTINUOUS ANALYSIS OF PLANT STREAMS. R. D. Dierks. June 1, 1957. 5p. Contract [W-31-109-Eng-52]. $1.80(ph OTS); $1.80(mf OTS).

The design is presented of a dual-filter photometer for the continuous colorimetric analysis of plant streams for dichromate concentration of an aqueous sample, uranium content of an aqueous sample, and uranium content of an organic sample. (W.L.H.)

1291 HW-56378

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
A SLOW AND FAST NEUTRON SCINTILLATION COUNT-RATE AND DOSE-RATE METER. W. G. Spear. Aug. 1, 1958. 26p. Contract W-31-109-Eng-52. $0.75 (OTS).

A compact, scintillation, transistorized slow and fast neutron count-rate and dose-rate portable instrument was developed. The basic instrument weighs approximately six pounds without moderator. A spherical 10-inch diameter paraffin moderator weighing 15 pounds is used with the instrument for fast neutron dose-rate determinations. A spherical polyethylene, 10-inch diameter moderator may also be used. The polyethylene moderator weighs 10 pounds. The thermal and slow neutron sensitivity is approximately 100 c/m/n/cm^2/sec or the first range full scale sensitivity is approximately 0.1 mrem/hr for thermal neutrons. Used with the 10-inch moderator, the instrument has an approximate dose-rate sensitivity of 10,000 c/m millirad/hour. For fast neutrons the instrument is energy independent to ± 20 per cent from 0.3 Mev to 2.5 Mev. The three ranges employed are: 0-1000, 0-10,000, and 0-100,000 c/m with the first range corresponding to 0.1 mrem/hr for the thermal and slow neutrons and to 0.1 mrad/hr for fast neutrons. The range sensitivities can be decreased by merely masking part of the crystal detector light-output window or by using a smaller crystal. The battery life is 110 hours with continuous operation. The instrument is not affected by radium gamma fields of less than three r/hr. (auth)

1292 ORINS-24

Oak Ridge Inst. of Nuclear Studies, Inc., Tenn.
THE TSUYATSCAN. Akira Tsuya and Marshall Brucer. Oct. 1958. 33p. $1.00(OTS).

This report contains both the English and Japanese versions.

Modifications were made in a standard radiation scanner to provide a method for mechanically obtaining a picture of the field of vision of a collimator. The detector was removed from the moving arm of a scanner and a point source substituted in its place. This point source is moved in a regular pattern across the field of vision of the detector and in so doing the detector maps the picture of its own field of vision. By substituting many kinds of collimators on this particular detector, it was possible to study in a qualitative manner the effects of various factors of definition. Applications in isodose determinations for gamma sources are discussed. (C.H.)

1293 SCTM-328-58(14)

Sandia Corp., Albuquerque, N. Mex.
ANTENNA COUPLING ERROR IN INTER-FEROMETER ANGLE-MEASURING SYSTEMS. C. W. Harrison, Jr. Aug. 25, 1958. 18p. Contract AT(29-1)-789. $3.30 (ph OTS); $2.40(mf OTS).

A rigorous analytical method for investigating antenna coupling error in interferometer angle-measuring systems is presented. (auth)

1294 SCTM-362-58(14)

Sandia Corp., Albuquerque, N. Mex.
APPROXIMATE THEORY OF MULTITUNED ANTENNA FOR VLF TRANSMISSION. Charles W. Harrison, Jr. Sept. 9, 1958. 20p. Contract AT(29-1)-789. $3.30 (ph OTS); $2.40(mf OTS).

A theory for multituned antennas is set forth and illustrated by discussion of an antenna with four down leads. Standard circuit concepts are used to obtain the impedance of a composite antenna constructed of side-loaded folded unipole building blocks. (J.R.D.)

1295 UCRL-4665

California. Univ., Livermore. Radiation Lab.
MEASUREMENT OF LARGE, HIGH-FREQUENCY, SHORT-PULSE CURRENTS USING A RADIAL SHUNT. H. Bruce McFarlane. May 22, 1956. 17p. Contract W-7405-eng-48. $3.30(ph OTS); $2.40(mf OTS).

The measurement of large, high-frequency, short-pulse currents—ordinarily complicated by inductance, stray magnetic fields, and magnetic forces that tend to disassemble the measuring device—is simplified and made with an average error of 2.5% by the use of a specially developed noninductive radial shunt in conjunction with an oscilloscope. The skin-effect correction is derived theoretically and the accuracy of the method is demonstrated. (auth)

1296 USNRDL-TR-258

Naval Radiological Defense Lab., San Francisco.
X Y PLOTTING WITH THE IBM MODEL 026 PRINTING CARD PUNCH. R. Ehat and R. A. Taylor. July 15, 1958. 43p.

An IBM Model 026 Printing Card Punch has been adapted to operate into a Mosely Model 30A card Translator and a Mosely Model 2 Recorder. The design permits the plotting of IBM card information on an XY Plotter (Mosely Model 2) without disabling the normal card punching and card duplicating functions of the IBM Model 026 Printing Card Punch. (auth)

1297 WADC-TN-58-105

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.
BIBLIOGRAPHY ON PHOTOGRAPHIC FILM DOSIMETRY. Period covered: December 1957 to February 1958. Gordon H. Griffith. April 1958. 24p. Project

title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: NUCLEAR ENGINEERING APPLICATIONS. (AD-155571).

This report contains a bibliography of several books and articles that have been published through 1957 on photographic film dosimetry. It has been divided into two parts, one for x and gamma radiation and the other for neutrons. Brief abstract type comments are included with each reference. (auth)

1298 WT-1530
Coast and Geodetic Survey, Washington, D. C.
SURFACE MOTIONS FROM AN UNDERGROUND EXPLOSION. D. S. Carder, W. K. Cloud, L. M. Murphy, and J. H. Hershberger. June 1958. 45p. Project 26-4d [of] OPERATION PLUMBBOB. $1.25(OTS).

Seismic effects of Rainier, a 1.7-kt nuclear shot detonated 900 feet underground, were measured in terms of ground surface motion at ten strong-motion seismograph stations located 1200 to 45,000 feet from the source. In addition, records were borrowed from seven teleseismic stations located 100 to 300 miles from the source. Data are tabulated and presented graphically. (C.H.)

1299 NP-tr-163
A RECORDING MICRO-BALANCE FOR DIFFUSION MEASUREMENTS ON PLASTIC MEMBRANES.
R. Vieweg and Th. Gast. Translated by S. Fitzgerald (U.K.A.E.A., Atomic Energy Research Establishment) from Kunststoffe 34, 117-19(1944). 10p.

The water-vapor permeability of plastic membranes can be measured accurately and automatically by gravimetric means if the diffusing vapor can be absorbed at constant pressure and weighed continuously. A recording micro-balance which meets these requirements is described. (C.H.)

1300 NP-tr-186
AUTOMATIC FREQUENCY TRIMMING CIRCUIT OF A SYNCHROGENERATOR. I. Yu. (Iu.) Klugman. Translated by Morris D. Friedman (Lincoln Lab., MIT) from Radiotekhnika 13, No. 3, 48-60(1958). 22p.

The operation of a "four diode" circuit used in the majority of native synchrogenerators is described herein. The condition for stability of operation of this circuit is derived and a relation is given between the circuit parameters and the stability condition. An experimental verification of the stability condition derived is presented. A computation of the circuit parameters is given which guarantees stable circuit operation for the best qualitative regulation indices. (auth)

1301 SCL-T-199
STUDY OF THE USE OF THERMISTORS FOR MEASURING LOW PRESSURES. (Etude sur l'Utilisation de Thermistances pour la Mesure des Basses Pressions). Milena Varicak. Translated by Marcel I. Weinreich (Sandia Corp.) from Compt. rend. 243, 893-5(1956). 4p.

Two series of experiments, one concerning the lowering of thermistor wall temperature and the other related to the heat dissipating surface of the thermistor, were conducted. The voltage drop across the thermistor traversed by a 1 ma current was recorded on an oscillograph, as the air pressure changed abruptly from 10^{-5} to 10^{-3} mm Hg. Thermal dissipation was effected by contacting a pearl with tin foil, and thermal equilibrium was reached in 45 seconds. The device can be used for measurement of pressures down to 10^{-6} mm Hg. (J.R.D.)

1302
REMOTELY OPERATED FILTER PHOTOMETER. M. T. Kelley, E. B. Wagner, W. L. Maddox, H. C. Jones, and D. J. Fisher (Oak Ridge National Lab., Tenn.). Anal. Chem. 30, 1711-12(1958) Oct.

Colorimetric analyses of radioactive samples are done remotely within cells in the High Radiation Level Analytical Facility. Manipulations of samples and instrument are done with a pair of master slave manipulators. Only the compact sensing unit is within the cell. This separation of components reduces slave movements to a minimum, saves valuable cell space, simplifies maintenance problems, and was found to be reliable and stable. (auth)

1303
NUCLEAR PHYSICAL MEASURING METHODS. V. THE IONIZATION CHAMBER. Werner Braunbek. Atomkern-Energie 3, 405-7(1958) Oct. (In German)

A survey is presented on the use of the ionization chamber in nuclear physics measurements. The basic principles of the chamber, measurements of ionization currents, chambers for alpha and beta radiation, chambers for x and beta radiation, chambers for other radiations, and the pulse ionization chamber are discussed. (J.S.R.)

1304
EFFECT OF THERMIONIC EMISSION AT ROOM TEMPERATURES IN PHOTOSENSITIVE GEIGER-MÜLLER TUBES. K. Grotowski, A. Z. Hrynkiewicz, and H. Niewodniczanski (Jagellonian Univ., Krakow). Bull. acad. polon. sci. Classe 3 1, No. 3-4, 109-11 (1953).

The temperature-dependence of the background of Geiger-Mueller counting tubes was compared for non-sensitized and sensitized (treated by electric discharge) tubes. A strong increase of background with increasing temperature was observed for photosensitive counters, while no change was observed in non-sensitized counters. It is shown that the increase is due to thermionic emission of the brass cathode. (T.R.H.)

1305
β-RAY SPECTROSCOPY USING A HOLLOW PLASTIC SCINTILLATOR. D. G. Gardner and W. W. Meinke (Univ. of Michigan, Ann Arbor). Intern. J. Appl. Radiation and Isotopes 3, 232-9(1958) Aug.

Specially designed plastic scintillators employing a hollow construction to minimize electron scattering have been used to study accurately β-spectral distributions down to energies of less than 0.1 Mev. This inexpensive addition to a scintillation γ-ray spectrometer makes possible resolution of the β-spectra of isotopic mixtures. This unit is of particular importance in multiple tracer studies involving pure β-emitters. (auth)

1306
A COUNTING ASSEMBLY FOR STUDY OF RADIOACTIVITY. P. Cotton and Y. Genin. J. phys. radium 19, 42S(1958) Aug.-Sept. (In French)

An inexpensive sturdy assembly for the study of radioactivity is described. It is of the classic type, consisting of a low pressure G-M tube, a counter, a device to measure the counting time, and a bench with simplified proportions. (J.S.R.)

1307
TWO MODELS OF ION SOURCES ADAPTABLE FOR MASS SPECTROMETERS. D. Blanc and A. Degeilh.

J. phys. radium 19, 61S-2S(1958) Aug.-Sept. (In French)

Two models of ion sources are described. One model is a source of the Nier type but it does not use an auxiliary magnetic field. Its operation was adapted to accelerations much higher than used to the present and it is adjustable from 0 to 12 kv. The source with high frequency excitation is of the Thonemann type. It gives a higher ion yield than the first source. (J.S.R.)

1308

ENTIRELY METALLIC ADJUSTABLE LEAK. P. Roubeau, J. M. Garin, and P. Prugne (Service de Physique Nucleaire, C.E.N. Saclay, France). Le vide No. 66, 453-5(1956) Nov.-Dec. (In French)

A description is given of an entirely metallic leak tap which allows the precise regulation of gas flow between 0.1 and 1000 cm^3-hr and which can be operated at will, mechanically or electrically, only requiring a very small energy: 200 g-cm or some tenths of a watt. (auth)

1309

THE IMPACT TESTING OF EXPLOSIVES. Paul W. Levy (Brookhaven National Lab., Upton, N. Y.). Nature 182, 37-9(1958) July 5.

An equation is presented from which one may obtain information about some of the properties of an explosive under study, and also information on the mechanical properties of the impact machine used in testing the sensitivity of the explosives. An illustrative example is included which uses data obtained with a Picatinny Arsenal impact machine. (C.H.)

1310

COMPUTING ABSOLUTE THERMAL NEUTRON FLUX FROM MEASUREMENTS MADE WITH INDIUM FOILS. Moses A. Greenfield (Univ. of California, Los Angeles) and Roscoe L. Koontz and Alan A. Jarrett (North American Aviation, Inc., Canoga Park, Calif.). Nuclear Sci. and Eng. 4, 563-9(1958) Oct.

The method for computing absolute thermal neutron flux from measurements made with activated indium foils is described. By combining data from the counting rate of indium foils in 2π proportional counters with appropriate corrections for foil weights and neutron effects, the thermal flux is expressed in terms of σ_0, the thermal absorption cross section of In^{115}. This procedure may be used by laboratories which do not have access to a standard graphite pile or to a standard neutron source. This method has an estimated error of less than 5% which is a function of the accuracy with which it is possible to determine the various correction factors for beta counting. A possible fixed error in the value of σ_0 can easily be corrected for and incorporated into the methods used. (auth)

1311

NEW PROPORTIONAL COUNTERS FOR GASES AND VAPORS. Richard Wolfgang (Yale Univ., New Haven) and C. F. Mackay (Haverford Coll., Penna.). Nucleonics 16, No. 10, 69-73(1958) Oct.

A description is given of three new designs for proportional counters which can be used in almost any work involving assay of labeled gases or volatile liquids. The three designs are a vapor counter for batch samples, window vapor-flow counter, and an internal vapor-flow counter. A comparison is made with the sensitivity and convenience of other systems. (J.S.R.)

1312

A MATRIX TO CORRECT FOR SCINTILLATOR ESCAPE EFFECTS. E. G. Rawson and D. V. Cormack (Univ. of Saskatchewan and Saskatoon Cancer Clinic, Saskatoon, Can.). Nucleonics 16, No. 10, 92-7(1958) Oct.

A matrix for the correction of scintillator escape effects is given in both its forward and inverse form. The preparation of the matrix is described, and the method used to evaluate the Compton escape data is discussed. (J.S.R.)

1313

PINHOLE CAMERA MAPS BETA-ACTIVE DEPOSITS. L. E. Preuss and G. Jenkins (Edsel B. Ford Inst. for Medical Research, Detroit). Nucleonics 16, No. 10, 98-9(1958) Oct.

An evacuated pinhole camera which can be used to examine beta-active deposits without the problems of contamination and radiation exposure involved in autoradiography and surface scanning is described. The advantages of the camera over other methods of deposition study are discussed. (J.S.R.)

1314

SLOW, SIMPLE 99-CHANNEL PULSE-HEIGHT ANALYZER. Gert Jensen, Kai Wilsky, Preben Holmgreen Jensen, and Flemming Thomsen (Finsen Lab., Copenhagen). Nucleonics 16, No. 10, 100-1(1958) Oct.

The design of a slow, comparatively simple, 99-channel pulse-height analyzer, which follows the analog-to-digital conversion principle, is given. The channel selector is also presented. (J.S.R.)

1315

PHOTOVOLTAIC GAMMA-RAY DOSIMETER. J. W. Moody, G. L. Kendall, and R. K. Willardson (Battelle Memorial Inst., Columbus, Ohio). Nucleonics 16, No. 10, 101-3(1958) Oct.

A photovoltaic cell which consists of an n-p junction formed by the diffusion of boron into 0.1 ohm-cm n-type silicon was tested for its response to gamma radiation. The results indicated that an application of the cell to gamma-ray dosimetry would be feasible. As the cell tested was designed for the efficient conversion of light to electrical energy, it was suggested that advantages might be gained by changing the design and parameters of the cell to be more applicable to gamma-ray dosimetry. (J.S.R.)

1316

MASS SPECTROMETERS IN INDUSTRY. (CONSTRUCTION AND NEW DEVELOPMENTS). V. A. Pavlenko, A. E. Rafael'son, and A. M. Shershevskii (All-Union Construction Bureau of Analytical Instrument-Construction). Pribory i Tekh. Ekspt. No. 3, 3-15(1958) May-June. (In Russian)

A review is presented of the developments in instrumentation and performance of mass spectrometers manufactured in Soviet Russia for industrial applications. Specifications are given for various models. (R.V.J.)

1317

DOUBLE FOCUSING IRON FREE BETA SPECTROMETER. V. F. Baranov (Moscow Inst. of Engineering Physics). Pribory i Tekh. Ekspt. No. 3, 15-21(1958) May-June. (In Russian)

Descriptions are given of a β spectrometer with a double-focusing electron beam at $\pi\sqrt{2}$ angle in a magnetic field of iron-free round coils. The mean plane of the magnetic field corresponds to the Pavinskii field or to the field described in double-focusing approximation theory. The radius of the stable orbit is 100 mm; the beam maximum angle of divergences in radial and axial directions are ±10 and ±6°, respectively. Relative half-width of the line is 0.59% with solid-angle 0.6%.

The instrument is used for maximum energies up to 0.3 Mev. (tr-auth)

1318

FAST NEUTRON SCINTILLATION SPECTROMETER. Yu. A. Egorov. Pribory i Tekh. Ekspt. No. 3, 21-6(1958) May-June. (In Russian)

Descriptions are given of two scintillation spectrometers of 45 and 70° scattering angles. The block diagram of the 70° spectrometer is given, and the methods of data processing are analyzed. The spectrometer is calibrated by measuring the α spectrum of Po^{210} and the β spectra of Cs^{134} and Sr^{89}. Measurements were made of fast neutron absorption spectra in concrete, water, and paraffin to check performance. Experiments show satisfactorily operation even in high γ background. (tr-auth)

1319

ON SOME PROBLEMS IN TECHNICS OF CRYSTAL-DIFFRACTION γ SPECTROMETERS. O. I. Sumbaev (All-Union Research Inst. of Metrology). Pribory i Tekh. Ekspt. No. 3, 27-31(1958) May-June. (In Russian)

The distortion effects of bent-crystal reflecting planes and parameters of crystal diffraction γ spectrometers were analyzed. It was found that the theoretically computed line width is in good agreement with the experimental value. Effects of the bent crystal thickness and curvature on the light and resolving power of spectrometers are evaluated. (tr-auth)

1320

ELECTROSTATIC ANALYZER FOR THE INVESTIGATION OF ANGULAR DISTRIBUTIONS OF CHARGED PRODUCTS IN NUCLEAR REACTIONS. V. F. Litvin (Radium Inst., Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 3, 32-4(1958) May-June. (In Russian)

Calculations are given for an electrostatic analyzer in which second-order focusing in a wide range of energies ($\Delta \Sigma/\Sigma \approx 200\%$) is accomplished by passing particles through a laminar condenser plate. The geometric focusing point is found at 10°54′ to the condenser plate. Particles on the coordinate of the focal line have a linear energy dependence and azimuthal symmetry. The light power is $\Omega = 0.33$ ster, with resolving power $R \approx 10^3$. (tr-auth)

1321

MEASUREMENTS OF THE ANGULAR AND ENERGY DISTRIBUTIONS OF RECOIL NUCLEI. F. P. Denisov and V. E. Kolesov (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 3, 34-6 (1958) May-June. (In Russian)

Descriptions are given of a simple method for measuring the angular and energy distributions of nuclear reaction products. (tr-auth)

1322

FOCUSING PROPERTIES OF ION REMOVAL SYSTEM IN HIGH-FREQUENCY ION SOURCE. A. N. Serbinov. Pribory i Tekh. Ekspt. No. 3, 39-45(1958) May-June (In Russian)

Dimensional effects on ion removal from high-frequency sources and on beam focusing were investigated. The optimum dimension systems with varying diameter channels showed that with discharge power near 130 vt and gas consumption 4, 8.5, and 13 cm^3/hr the ion currents are 0.88, 0.95, and 1.35 ma, respectively. The content of atomic ions is $\approx 80\%$. (tr-auth)

1323

LARGE PLASTIC SCINTILLATORS. M. N. Medvedev, E. N. Matveeva, and L. Ya. Zhil'tsova (Joint Inst. of Nuclear Research). Pribory i Tekh. Ekspt. No. 3, 45-8 (1958) May-June. (In Russian)

The preparation of 3-liter and above plastic scintillators is described. Pulse amplitudes from the large-volume scintillators relative to the points of irradiation are tabulated. (tr-auth)

1324

20 CHANNEL TIME ANALYZER FOR TIME-OF-FLIGHT SELECTION OF FAST NEUTRONS. A. I. Veretennikov and V. Ya. Averchenkov. Pribory i Tekh. Ekspt. No. 3, 48-53(1958) May-June. (In Russian)

A time analyzer based on the principle of time transformation into amplitude is described. The scheme proposed by G. C. Neilson and D. B. James (Rev. Sci. Instr. 26, 1018(1958)) is supplemented by features securing a certain sequence in the selection of incoming pulses. The practical resolving power of the analyzer is 1.5 to 3 sec, electrical resolving time 0.45 sec, and channel boundary 0.5 sec. Descriptions are given of the analyzer performance in time-of-flight selection of neutrons from Po—Be. (tr-auth)

1325

MEASUREMENTS OF NUCLEAR ABSORPTION LINE WIDTH AND GRADIENT OF MAGNETIC FIELD AT NARROW LINE INTENSIFICATION. A. V. Kubarev (All-Union Research Inst. of Metrology, Sverdlovsk Div.). Pribory i Tekh. Ekspt. No. 3, 68-70(1958) May-June. (In Russian)

Peculiarities in nuclear resonance absorption signals at narrow line intensifications for cases of linear and sinusoidal modulations are analyzed. Opportunities for measuring the resonance curve width in relation to the amplitudes in a wide range of modulations and theoretical possibilities for direct evaluation of gradient field by the width of the line are shown. The results are in good agreement with the experimental data and are compared to the measured magnitudes on the dispersion curve at narrow line intensification and narrow modulation. (R.V.J.)

1326

EFFECTS OF CATHODE SURFACE PROCESSING METHODS ON THE SPECTRAL SENSITIVITY OF PHOTON COUNTERS. D. M. Eremin (Khar'kov Inst. of Transportation). Pribory i Tekh. Ekspt. No. 3, 76-9(1958) May-June. (In Russian)

Experiments were made for determining the factors affecting the electron yield due to phase changes on the metal surfaces. The photon counter spectral sensitivity in relation to the crystalline structure of the metal layer and the thickness of the layer is analyzed, as well as the counters with photocathodes prepared from metals deposited on glass by evaporation in vacuum. (R.V.J.)

1327

SUPER HIGH COMPRESSION WITH HIGH TEMPERATURE APPARATUS. S. S. Boksha and G. P. Shakhovskoi (Inst. of Crystallography, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 3, 86-90(1958) May-June. (In Russian)

The design is given of an apparatus for gas compression up to 30,000 kg/cm^3 with simultaneous temperature development to 2000°C. The method for obtaining super-high gas compression using solid carbon oxide is presented. The relation of Al and Cu melting points to the compression was investigated and black crystalline phosphor melt was obtained. It is shown that the Al and Cu melting points increase with the increase in compression. Only amorphous and crystalline modifications of black phosphorus was found in the investigated range of temperatures and compressions. (tr-auth)

1328

CHAMBER FOR X-RAY STRUCTURAL INVESTIGATIONS OF MONOCRYSTALS AT HIGH COMPRESSION. L. F. Vereshchagin, S. S. Kabalkina, and V. V. Evdokimova (Lab. of Super-High Compressions in Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 3, 90-2(1958) May-June. (In Russian)

The construction of an x-ray rotation chamber for studying monocrystals up to 7000 kg/cm^3 pressure is presented. The compression is accomplished by a steel piston, (secured to the working position by a nut) with benzene acting as transmitting liquid. The compression is measured with a manganin manometer. The x-ray diffraction of NaCl rotation at 4000 kg/cm^3 pressure was studied. (tr-auth)

1329

HIGH FREQUENCY PULSED ION SOURCE. G. S. Malkiel and B. I. Sukhanov. Pribory i Tekh. Ekspt. No. 3, 100-1(1958) May-June. (In Russian)

A high-frequency source producing pulsed ion currents of 100 to 200 ma, with 1μsec duration, and 1000 amp/sec frequencies is described. (tr-auth)

1330

WATER-CONTAINING FLUIDS IN BUBBLE CHAMBER OPERATION AT ROOM TEMPERATURE. M. F. Lomanov and V. A. Shchegolev. Pribory i Tekh. Ekspt. No. 3, 103(1958) May-June. (In Russian)

Two freons showed satisfactory performance in bubble chambers at 20 to 30°C. However, the absence of hydrogen nuclei is a draw back in investigations of elementary processes. Experiments show some favorable indications for applications of ethane–propane mixtures. (R.V.J.)

1331

CHARACTERISTICS OF A PULSE GENERATOR FOR OPERATIONS WITH AMPLITUDE ANALYZER. A. A. Markov and G. N. Sofiev. Pribory i Tekh. Ekspt. No. 3, 110-13(1958) May-June. (In Russian)

The characteristics and design are presented for a generator with linearly changing and standard pulses for use with amplitude analyzers, accelerators, and other pulse instruments. (tr-auth)

1332

ION CURRENT STABILIZATION FOR A SURFACE IONIZATION MASS SPECTROMETER. B. R. F. Kendall (Univ. of Western Australia, Nedlands). Rev. Sci. Instr. 29, 851-4(1958) Oct.

It is shown that ion current stabilization for surface ionization mass spectrometers offers many advantages over the conventional methods of regulation which effectively stabilize the sample temperature. A technique is described which allows accurate measurement of very small relative isotopic abundances. A number of problems associated with the design of circuits for emission stabilization of surface ionization sources are considered. A successful stabilizer which maintains the ion current from such a source at a constant value by variation of the source filament temperature is described and the performance when used for the control of potassium positive ion sources is discussed. The stabilizer is capable of reducing ion current drifts, such as those due to exhaustion of the sample, by a factor of 130. (auth)

1333

CRYOSTAT FOR ELECTRON BOMBARDMENT AND ELECTRON DIFFRACTION WORK. Erwin M. Hörl and L. Marton (National Bureau of Standards, Washington). Rev. Sci. Instr. 29, 859-61(1958) Oct.

A cryostat was constructed for the production of free radicals by electron bombardment of condensed gases at liquid helium and liquid hydrogen temperature. Provisions were made for simultaneous investigations of the bombardment products by electron diffraction and optical spectroscopy. (auth)

1334

DIFFERENTIAL PRESSURE GAUGE FOR USE WITH LIQUIDS AND CORROSIVE FLUIDS. H. E. Flotow, B. M. Abraham, and R. D. Carlson (Argonne National Lab., Lemont, Ill.). Rev. Sci. Instr. 29, 869-70(1958) Oct.

A sensitive, rugged pressure gauge is described that was developed to determine the density (composition) and the viscous pressure loss in flowing streams of UO_2-NaK slurries. The differential pressure sensors are two metal bellows that are rigidly connected in opposition, the net displacement of which is detected by a linear variable differential transformer. The sensitivity of the unit is 0.05 mm Hg pressure and the range is 100 mm Hg with an accuracy of ±0.4%. By simply inserting various calibrated springs in the instrument it is possible to increase or decrease the range and maintain the sensitivity at 0.05% of the range. (auth)

1335

30-INCH PROPANE BUBBLE CHAMBER. Wilson M. Powell, William B. Fowler, and Larry O. Oswald (Univ. of California, Berkeley). Rev. Sci. Instr. 29, 874-9 (1958) Oct.

A propane bubble chamber with a sensitive volume of 30.5 in. by 21.5 in. by 6.5 in. deep operating in a magnetic field of 14,000 gauss is described. Operating parameters and some engineering details are given. The part of the chamber containing the propane is hydrostatically supported in oil through which the chamber is photographed. This permits the use of small glass windows with a large safety factor. (auth)

1336

MAGNETIC SPECTROMETER FOR 450-Mev PROTONS. A. V. Crewe (Univ. of Chicago). Rev. Sci. Instr. 29, 880-4(1958) Oct.

A 60° wedge-focusing magnetic spectrometer was built for use with the 450-Mev proton beam of the Chicago synchrocyclotron. It has curved pole edges to produce good focusing in one plane only. The minimum line width obtainable is ~0.25% with an available solid angle of ~1/2000 sterad. The deflection is vertical, and angular distributions can be measured from 7° to 173° without allowing the primary beam to strike the magnet yoke. (auth)

1337

COMBINED MAGNETIC SPECTROGRAPH AND SPECTROMETER. Harald A. Enge (Massachusetts Inst. of Tech., Cambridge). Rev. Sci. Instr. 29, 885-8(1958) Oct.

A combination instrument is proposed in which a broad-range magnetic spectrograph can be operated as such or in connection with a magnetic quadrupole lens to form a high-intensity spectrometer. A solid angle of approximately 10^{-2} steradian can be attained with this spectrometer without use of very large magnet gaps. (auth)

1338

CEMENT FOR SCINTILLATORS. Robert J. Omohundro

(U. S. Naval Research Lab., Washington). Rev. Sci. Instr. 29, 893(1958) Oct.

The use of viscous optical coupling media in photomultiplier-scintillator assemblies intended for field use has the disadvantage that gradual loss of the coupling compound may occur. A coupling cement has been developed which has good optical properties and has proven of considerable value in eliminating this difficulty. (A.C.)

1339
PRECISION LIQUID NITROGEN TRAP LEVEL CONTROLLER. George F. Wells (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 29, 893-5(1958) Oct.

A very simple system for controlling the liquid nitrogen level in a diffusion pump trap is described. The system uses a tightly fitting head which performs the functions of filling, venting, and level sensing, and a solenoid valve operated by the level-sensing device to close the vent on the liquid nitrogen container. (A.C.)

1340
HIGH-PRESSURE GAS-TO-LIQUID TRANSDUCER. Don O. Coffin (Los Alamos Scientific Lab., N. Mex.). Rev. Sci. Instr. 29, 896(1958) Oct.

A transducer is described which can withstand differential overpressure of 20,000 psi in either direction, while retaining high sensitivity during balance. (A.C.)

1341
X-RAY DOSAGE MEASUREMENTS BY MEANS OF THIN LUMINOUS FOILS. R. Glocker and D. Messner (Technische Hochschule, Stuttgart). Z. Physik 152, 538-45(1958). (In German)

The preparation of thin artificial foils with 1% terphenyl are described. It is shown that the measurement of the fluorescence intensity is a measurement of the dose in muscle and bone equivalent layer thicknesses from the order of magnitude of the range of the secondary electrons. The results obtained from the measurements are compared with theoretical results. (tr-auth)

1342
A CAMERA WITH SPHERICAL IONIZATION AND 2π GEOMETRY FOR α MEASUREMENTS. D. Prosperi, L. Riva, and S. Sciuti. pp. 707-10 in "Studi e ricerche della divisione geomineraria, Volume I, Parte II." Rome, Comitato Nazionale per le Ricerche Nucleari, 1958. 452p. (In Italian)

An α detector of spherical symmetry is described. It is able to work either as ionization chamber or as proportional counter. If employed as ionization chamber it attains an accuracy of 5% with the α line of Po^{210} and an emitting surface of 43 cm^2. In use as a proportional counter, a plateau of 500 v is easily obtainable. (auth)

METALLURGY AND CERAMICS

1343 AD-139336
Ohio State Univ. Research Foundation, Columbus.
PROTECTION OF NIOBIUM AGAINST OXIDATION AT ELEVATED TEMPERATURES. Final Report on Protection of Molybdenum Against Corrosion at High Temperatures. Annual Report For the Period: July 16, 1956—July 15, 1957. J. W. Spretnak and Rudolph Speiser. 27p. RF Project 467, Report No. 15. Contract N6onr-225(28) (NR039-005).

Pure niobium sheet was oxidized in air to provide a basis of comparison with the oxidation behavior of the binary and ternary alloys prepared. The binary alloys in the Nb—Zr system were prepared and oxidized. Alloys containing 90 wt. % Nb and 80 wt. % Nb were less resistant to oxidation than pure Nb. An alloy of 70 wt. % Nb—30 wt. % Zr alloy had slightly better oxidation resistance than pure Nb at 860°C. Binary alloys in the Nb—Ti system were prepared and oxidized at 860°C. The oxidation resistance was found to be greater than pure Nb. The oxidation rate of Nb—Mo—Si system was lower than pure Nb. The oxide films formed were not protective. (J.E.D.)

1344 AECU-3863
[Los Alamos Scientific Lab., N. Mex.].
TANTALUM: A BIBLIOGRAPHY OF PHASE DIAGRAMS AND PROPERTIES OF TANTALUM SYSTEMS (1953 THROUGH 1957). Helen Stearns, comp. 35p. (D-BIB-17). $6.30(ph OTS); $3.00(mf OTS).

A bibliography of phase diagrams and properties of tantalum systems, 1953 through 1957, is presented. The list is neither exhaustive nor critical. (J.R.D.)

1345 AECU-3865
Syracuse Univ., N. Y. Research Inst.
PLASTICITY OF ROLLED SANDWICH PLATES. Final Report, Amendment No. 3. Cosimo Torre. Oct. 1958. 78p. For Westinghouse Electric Corp. [Bettis Plant]. Contract AT(30-1)-2211, Subcontract No. 73-(14-457). (ME-413-589F). $12.30(ph OTS); $4.50(mf OTS).

Sandwich plates were tested photoelastically. The principal shear stress trajectories which are identical with the slip lines for an ideal plastic body were computed. A comparison between a rolled and a compressed sheet is given. (W.L.H.)

1346 AECU-3870
California. Univ., Berkeley. Minerals Research Lab.
SUBSTITUTIONAL SOLID SOLUTION-STRENGTHENING OF COPPER ALLOYS. Technical Report No. 16. Carl D. Wiseman, Earl R. Parker, and Thomas H. Hazlett. June 1957. 55p. Contract AT(11-1)-34, Project No. 29. (M-6332). $9.30(ph OTS); $3.60(mf OTS).

The object of this investigation was to determine the cause of substitutional solid-solution strengthening. Shear tests were conducted on single crystals of high-purity copper and of copper—manganese and copper—aluminum alloys. Each specimen was tested at room temperature after anneals at various temperatures. The specimens were next deformed in a manner that introduced substructure and then tested again after various anneals. An attempt was made to interpret the results in terms of current theories of solution strengthening. It was concluded that solution strengthening was due to the interaction of solute atoms with the substructure in the metallic lattice. Solution strengthening was found to be structure sensitive and hence it was not possible to find a simple law defining this phenomenon. (auth)

1347 AFOSR-TN-58-828
Illinois. Univ., Urbana.
STUDIES OF THE STABILITY OF HIGH TEMPERATURE RESISTANT CERAMIC COATING GLASSES. Report No. 82. William R. Bratschun, C. N. Williams, and Dwight G. Bennett. July 1958. 39p. Contract AF18(603)-28. (AD-202913).

Chemical and physical mechanisms were studied which were believed responsible for the instabilities of the glassy phase of composite glass-metal systems when subjected to elevated temperatures over prolonged periods of time. Two prominent types of glass devitrification behavior were indicated by x-ray-diffraction analysis of a series of glass-metal composite specimens which had been heat treated up to 200 hours at 870°C. (1) The cyclic development, disappearance and reappearance of various diffraction peaks which indicated considerable crystalline activity, (2) For certain glasses the early development of diffraction peaks which persisted throughout the heat treating period. This behavior indicated an equilibrium between the products of devitrification and the residual glass. A simple barium borosilicate glass was compared with a complex glass which was composed of 70 per cent by weight of the simple glass plus five modifying oxides. When identically heat treated, it was found that the simple glass devitrified more rapidly than the complex glass, although the same crystalline products were formed. Heat treatments on composite glass-metal specimens with glasses intermediate in composition between the simple and complex glasses revealed that at temperatures of 815 and 870°C all of the glasses devitrified in a short time. However, at 760°C some of these glasses resisted initial devitrification for over 50 hours. Single oxide additions of CaO, ZnO, TiO_2, Bi_2O_3, and CeO_2 to the simple glass all delayed to some extent the initial appearance of the devitrification products found in the simple glass. On firing to form the composite glass-metal specimens ceria crystals precipitated from the ceria containing glasses, and these remained as a separate phase during subsequent heat treating. As determined by microscopic examination, ceria additions to the simple glass had two principal effects: (1) At lower heat treating temperatures an outside layer of crystalline ceria developed. (2) Relatively low temperature melting glasses were formed which permitted the development of recognizable crystalline modifications of silica and barium disilicate at lower heat treating temperatures than the original simple barium borosilicate glass required. (auth)

1348 AFOSR-TR-58-127
Chicago Development Corp., Riverdale, Md.
RESEARCH ON INTERSTITIAL SOLUTES IN METALS. R. S. Dean and I. Hornstein. Aug. 1958. 86p. Project No. 19751. Contract AF18(600)-1458. (AD-203362).

Studies are reported on the free energy considerations with regard to the anodic refining of Ti alloys containing O_2. The electrorefining process of the Chicago Development Corporation for Ti alloys is discussed. (W.L.H.)

1349 ANL-5790
Argonne National Lab., Lemont, Ill.
METALLURGY DIVISION QUARTERLY REPORT [FOR] APRIL, MAY, AND JUNE 1957. July 1958. 60p. Contract W-31-109-eng-38. $1.75(OTS).

Advanced Water Reactor Program. Seven reaction couples were studied for 60 days at 600 and 800°C: ThO_2-UO_2 with Zircaloy-2, stainless steel, lead, and graphite; lead with Zircaloy-2 and stainless steel; and graphite with Zircaloy-2. No reactions were observed at 600°C and only lead–Zircaloy-2 appeared to react at 800°C. Fast Power Breeder Reactor Program. EBR-I Mark III core is being fabricated. Tests in Borax-IV on ThO_2-UO_2 pellets lead-bonded to Al–1 wt. % Ni tube sheets showed fracturing dependent on UO_2 content. Non-destructive testing development continued. Alloying with Ru showed no improvement in corrosion properties of U. Corrosion of M388 Al alloy as affected by phosphate, pH, and flow rate were studied. Production, Treatment, and Properties of Materials. Plastic deformation and thermal conductivity of U single crystals was studied. Investigation of recrystallization of alpha-U without a texture change continued. Tests of French uranium are reported. Barrier layers of UO_2 were found in sputtering of Zr and U onto U, probably resulting from impurities in the argon used. Phase transformations in the U–C system were studied, and gamma U lattice parameters for 900°C annealed and water quenched U–Mo–Ru are given. Studies are also reported on the Zr corrosion mechanism and sintering of ceramic materials. (For preceding period see ANL-5717.) (T.R.H.)

1350 BMI-1297
Battelle Memorial Inst., Columbus, Ohio.
COATING OF URANIUM DIOXIDE POWDERS WITH METALLIC TUNGSTEN FILMS. Joseph H. Oxley, James F. Hannah, John M. Blocher, Jr., and Ivor E. Campbell. Oct. 8, 1958. 13p. Contract W-7405-eng-92. $0.50(OTS).

Conditions for the tungsten coating of uranium dioxide powders by hydrogen reduction of tungsten hexachloride in a fluidized bed of the powder product have been established. The coated material should contain approximately 20 wt. % tungsten in order to obtain essentially complete coverage of micron-size uranium dioxide. (auth)

1351 CCC-454-TR-294
Callery Chemical Co., Penna.
STANDARD X-RAY DIFFRACTION POWDER PATTERNS. P. I. Henderson, H. G. Norment, and H. J. Birch—S. L. Harvey, ed. Aug. 15, 1958. 66p. Project ZIP. Contract NOa(s)-58-454-d.

Thirty-nine standard x-ray-diffraction powder patterns, largely boron compounds, are presented. Qualitative intensity data are given for most patterns. These intensity data will be included in future reports. (auth)

1352 CEA-730
France. Commissariat à l'Énergie Atomique, Paris.
CONTRIBUTION A L'ÉTUDE MICROGRAPHIQUE DE L'URANIUM ET DE SES ALLIAGES. (Contribution to the Micrographic Study of Uranium and Its Alloys.) Henri Monti. 1957. 63p.

Studies made to perfect micrographic techniques applicable to the study of samples of irradiated uranium are reported. In an investigation of the electrolytic polishing of uranium, two baths were developed which gave satisfactory results, a perchloric acid–ethanol mixture and a phosphochromic–ethanol bath. The micrographic attack of uranium was studied. It was shown that the oxidation in a boiling concentrated solution of sodium nitrate gives an excellent micrographic attack on uranium, if the samples were polished in a perchloric bath. As this method presents inconveniences, the method of chemical oxidation on the uranium surfaces polished in other baths was investigated. It was shown that after an anodic attack at the minimum potential of electrolytic decomposition, chemical oxidation of the surfaces treated forms epitaxic layers which show the uranium structure perfectly. The application of these techniques to alloys of uranium with aluminum, zirconium, and molybdenum is described. In the appendix, it is shown how the methods of polishing and attack may be used in the characterization and identification of hydride, carbide, and nitride inclusions in molten uranium. 60 references. (J.S.R.)

1353 CF-54-6-126
Oak Ridge National Lab., Tenn.
AIRCRAFT NUCLEAR PROPULSION: FLUORIDE FUEL PREPARATION FACILITY. E. F. Joseph, F. L. Daley, B. A. Hannaford, and E. L. Youngblood. June 1, 1954.

Decl. Sept. 26, 1958. 41p. Contract W-7405-eng-26. \$6.30(ph OTS); \$3.00(mf OTS).

A description of the Fluoride Fuel Preparation Facility for the production of 250-pound units of $NaF-ZrF_4-UF_4$, $NaF-ZrF_4$, and $NaF-UF_4$ is presented. The facility consists of an arrangement of three cubicles. Cubicle No. 1 contains equipment for weighing and mixing. Cubicles 2 and 3 contain a reactor where the mixture is treated, and a receiver to which the purified melt is transferred for storage. The flow diagram of the system is given. (W.L.H.)

1354 DP-205

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

ELECTROLYTIC REDUCTION OF THORIUM OXIDE. Leon H. Meyer. Feb. 1957. Decl. Oct. 15, 1958. 20p. Contract AT(07-2)-1. \$3.30(ph OTS); \$2.40(mf OTS).

Thorium metal has been produced by electrolytic reduction of thorium oxide. Reduction was accomplished in both a $KF-ThF_4$ melt and a $NaCl-KCl-ThCl_4$ melt. A flowsheet for the complete process using the fused fluoride system is proposed. (auth)

1355 HW-52035

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PLUTONIUM FUELS DEVELOPMENT—PLUTONIUM METALLURGICAL DEVELOPMENT QUARTERLY REPORT [FOR] OCTOBER, NOVEMBER, DECEMBER 1956. O. J. Wick. Aug. 22, 1957. 6p. Contract [W-31-109-Eng-52]. \$1.80(ph OTS); \$1.80(mf OTS).

The melting, casting, and radiographic inspection of the Al—Pu fuel elements for PCTR testing are described. The fabrication of U—Pu alloy elements to determine the effect of extended pile exposure on the reactivity constants and to determine the temperature coefficient of reactivity of standard natural uranium fuel elements is described. (W.D.M.)

1356 HW-55667

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

ELECTRON BEAM VACUUM WELDING—DEVELOPMENT OF PROCESS. W. L. Wyman and W. I. Steinkamp. Apr. 8, 1958. 45p. Contract W-31-109-Eng-52. \$7.80(ph OTS); \$3.30(mf OTS).

Developmental work on an electron beam vacuum welding process for use in fabricating nuclear fuel elements is described. It is concluded that fuel elements clad with zirconium alloys, stainless steels, and aluminum can be welded by this method, as well as most metals used in industry. Improvements in weld quality are obtained, and welding costs can be reduced in many cases. (J.R.D.)

1357 HW-56843

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

TRANSFORMATION KINETICS OF PLUTONIUM. PART II. A STUDY OF THE GAMMA TO BETA TO ALPHA AND ALPHA TO BETA TO GAMMA TRANSFORMATIONS. R. D. Nelson. July 18, 1958. 21p. Contract W-31-109-Eng-52. \$3.30(ph OTS); \$2.40 (mf OTS).

The kinetics of the $\gamma \rightarrow \beta \rightarrow \alpha$, $\beta \rightarrow \gamma$, and $\alpha \rightarrow \beta \rightarrow \gamma$ transformations were determined with a fluid displacement technique. The rates of formation of the alpha and beta phases from the gamma phase were determined after gamma heat treating and allowing a sample to transform isothermally in the alpha and beta ranges. Isothermal reaction curves were obtained from 160 C to −78C. The time-temperature-transformation curve of the $\gamma \rightarrow \beta \rightarrow \alpha$ transformation was plotted. The effect of the gamma heat treating time and temperature on the rate of transformation was examined. Isothermal reaction curves and time-temperature-transformation curves of the $\beta \rightarrow \gamma$, and $\alpha \rightarrow \beta \rightarrow \gamma$ transformations were plotted. Photomicrographs of specimens having transformed from the gamma range at different rates of transformation are presented. (auth)

1358 IGR-R/CA-285

United Kingdom Atomic Energy Authority. Industrial Group. H. Q., Risley, Lancs, England.

PIVOTED-PAD JOURNAL BEARINGS LUBRICATED BY GAS. L. N. Snell. May 18, 1958. 31p. \$0.49(BIS).

In a gas-lubricated bearing system, radial location for a rotating shaft is usually satisfactorily provided by a plain gas journal bearing. In some applications, however, the pivoted-pad journal bearing may be a more practical proposition. Some exploratory work on self-acting gas-lubricated pad bearings is described and shows that they are a reliable and stable alternative to the plain gas journal bearing. Their main disadvantage is associated with manufacture and assembly, both of which are more complicated than with journal bearings. Load-minimum gap curves and pressures within the film were measured; the results conform generally with the theory of the plane slider for an incompressible fluid. Theoretical expressions are deduced for the gas film stiffness and resonant frequency of the various modes of vibration which pad bearings are likely to exhibit. Such expressions enable a useful estimate to be made of the operating limits of a pad bearing of given design. (auth)

1359 ISC-830

Ames Lab., Ames, Iowa.

A THEORETICAL STUDY OF THE ELECTRONIC STRUCTURE OF TRANSITION-METAL COMPLEXES. James W. Richardson and R. E. Rundle. Aug. 1956. 124p. Contract W-7405-eng-82. \$2.75(OTS).

A single theoretical approach to the understanding of the electronic structure and properties of transition-metal complexes is developed which is applicable to any such system regardless of the experimentally measured magnetic properties. This approach combines the quantitative advantages of the physical or crystalline field theory with the intuitive advantages of the chemical or hybrid orbital theory. Results are presented from a semi-empirical treatment of the fluoride and ammonia ligands, and the approximations inherent in the theory and calculations are exposed for their bearing upon the conclusions. 117 references. (C.H.)

1360 KAPL-M-CGL-1

Knolls Atomic Power Lab., Schenectady, N. Y.

THE INTER-RELATION OF LOOP OR REACTOR SYSTEM TRANSPORT AND DYNAMIC CORROSION IN WATER. C. G. Lindquist. Sept. 12, 1958. 12p. Contract W-31-109-Eng-52. \$3.30(ph OTS); \$2.40(mf OTS).

The conditions in which the flow of fluid past a corroding surface could affect the corrosion rate are outlined, and the formulation of these factors is discussed. In addition, an analysis of transport in dynamic corrosion loop systems is presented. (J.R.D.)

1361 LA-2231

Los Alamos Scientific Lab., N. Mex.

THE PREPARATION OF PLUTONIUM ALLOYS IN THE REDUCTION PROCESS. A. N. Morgan, Jr., C. A. Emery, and C. A. Rendell. Dec. 1957. 6p. Contract W-7405-eng-36. \$0.50(OTS).

Homogeneous binary alloys of plutonium with aluminum, iron, cobalt, nickel, copper, and uranium have been prepared in the reduction process. The method is not applicable for plutonium–zirconium or plutonium–cerium alloys. (auth)

1362 NAA-SR-2852
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
THE OXIDE-DROSSING FURNACE FOR THE PROCESSING REFABRICATION EXPERIMENT. J. L. Ballif. Sept. 1, 1958. 56p. Contract AT-11-1-GEN-8. $1.50 (OTS).

An engineering mock-up was carried out to demonstrate the remote operation and maintainability of the oxide-drossing phase of the PRE process. This effort included installation and full-scale operation of a high-frequency air melting induction furnace; and the design, fabrication, and modification of remotely operated supporting devices such as molds, metal chargers, ventilation hoods, and transfer equipment. It was demonstrated repeatedly that remote operation of this equipment can be carried on in a cell with only a crane for service. The time required for a cycle was $2\frac{1}{2}$ hours. The results of this experience were translated into drawings and specifications for equipment to be utilized in future "hot" facility work. (auth)

1363 NACA-TN-4284
Alabama. Univ., Tuscaloosa.
CUMULATIVE FATIGUE DAMAGE AT ELEVATED TEMPERATURE. William K. Rey. Sept. 1958. 54p.

A study of cumulative fatigue damage at elevated temperatures was conducted using heat-treated SAE 4130 alloy steel. The S-N curves at room temperature, 400 and 800°F were obtained from rotating-beam fatigue tests. Two-step, three-step, and five-step cumulative-damage fatigue tests were conducted on rotating-beam fatigue specimens at room temperature, 400 and 800°F. The results of the cumulative-damage tests are compared with those of a theoretical analysis. (auth)

1364 NACA-TN-4331
Langley Aeronautical Lab., Langley Field, Va.
AN INVESTIGATION OF THE EFFECTS OF ATMOSPHERIC CORROSION ON THE FATIGUE LIFE OF ALUMINUM ALLOYS. Herbert A. Leybold, Herbert F. Hardrath, and Robert L. Moore. Sept. 1958. 18p.

Fatigue tests were conducted on 100 vibrating cantilever sheet specimens by applying 4,000 cycles of load in a 10-minute period each working day while the specimens were subjected to atmospheric conditions over a period of several months. Specimens of 2024-T3 and 7075-T6 aluminum alloys in both the bare and clad forms were tested. For comparison, 96 specimens were tested indoors. Atmospheric effects shortened the average lives of the specimens by a factor of about 3 for 7075-T6 and 2024-T3 in the bare condition and by a factor of about 1.5 for 7075-T6 in the clad condition, and had no significant effect on the average life of 2024-T3 clad specimens. (auth)

1365 NACA-TN-4408
Lewis Flight Propulsion Lab., Cleveland.
THE THEORY OF DIFFUSION IN STRAINED SYSTEMS. Louis A. Girifalco and Hubert H. Grimes. Sept. 1958. 51p.

A general theory of solid-state diffusion in strained systems is developed on a molecular-kinetic basis. The theory predicts that for simple strains the diffusion coefficient is an exponential function of the lattice parameter and that the rate of change of the diffusion coefficient with strain is linearly related to the interatomic forces. It has also been shown that for plastic flow the diffusion coefficient is a linear function of strain rate. All these conclusions are confirmed by the data available in the literature. (auth)

1366 NAVORD-4893(Suppl. 1)
Naval Ordnance Test Station, Inyokern (China Lake), Calif.
ROCKET REFRACTORIES, A BIBLIOGRAPHY. Sylvia E. Christensen. May 10, 1957. 76p. (NOTS-1551).

This bibliography on rocket refractories contains 615 items. Literature on the application of these materials as protective coatings, combustion-chamber liners, and nozzles is emphasized. Some references on the composition of refractories and on their capabilities and modes of fabrication are included. (auth)

1367 NMI-4350
Nuclear Metals, Inc., Cambridge, Mass.
POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period May 30 through June 23, 1957. A. M. White and J. Greenspan. Aug. 1, 1957. 10p. Contract AT(30-1)-1565. $1.80(ph OTS); $1.80(mf OTS).

Work was continued on the development of satisfactory techniques for coextruding Zircaloy-2-clad uranium and uranium–2 wt. % zirconium fuel tubes. The permeability of FS1 magnesium (3% Al, 1% Zn, 0.3% Mn) to gaseous hydrogen was measured. The value $S = 6.7 \times 10^{-4}$ was obtained. (D.E.B.)

1368 NMI-4351
Nuclear Metals, Inc., Cambridge, Mass.
POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period June 24 Through July 19, 1957. A. R. Kaufmann, A. M. White, S. Isserow, and J. Greenspan. Aug. 1, 1957. 19p. Contract AT(30-1)-1565. $3.30(ph OTS); $2.40 (mf OTS).

Progress in the development of Zircaloy clad uranium tubular fuel elements is briefly reviewed. Additional corrosion tests were made on defected Zircaloy-clad U–Zr alloy specimens to further establish the effects of Zr content on corrosion by water. Measurements were made of hydrogen diffusion through Al and Mg claddings on U and the subsequent swelling due to hydride formation. The permeability of FS1 magnesium (Al–Mg–Zn) to hydrogen was determined at 350 and 450°C. Values of S were 0.326×10^{-4} and 1.55×10^{-4}. (For preceding period see NMI-4350.) (D.E.B.)

1369 NMI-4353
Nuclear Metals, Inc., Cambridge, Mass.
POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period July 20, 1957 through August 20, 1957. A. M. White, S. Isserow, and A. R. Kaufmann. Sept. 3, 1957. 10p. Contract AT(30-1)-1565. $1.80(ph OTS); $1.80(mf OTS).

Tests to determine the effects of Zr content on the corrosion of U–Zr alloys by water were continued. Results are given from studies of dimensional changes in Zircaloy-clad U–2 wt. % Zr extruded tubes resulting from pickling and horizontal diffusion heat treatment. (For preceding period see NMI-4351.) (D.E.B.)

1370 NMI-4354
Nuclear Metals, Inc., Cambridge, Mass.
POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period

August 21, 1957 through September 20, 1957. A. M. White, P. D. Corzine, L. R. Aronin, J. L. Klein, and S. Isserow. Sept. 25, 1957. 20p. Contract AT(30-1)-1565. $3.30(ph OTS); $2.40(mf OTS).

In the production of tubes with U–2 wt. % Zr cores and 15 mils of Zircaloy-2 cladding, a satisfactory front end-shape for the model tubes was obtained by using a copper nose plug with a 60° included angle, a matching steel cone, and a billet having a flat interface between the Zircaloy-2 end seal and the U–Zr core. The full-scale tubes were redesigned to allow for a pickling loss of one mil of Zircaloy-2 on each surface and for an expansion of three mils during heat treating. A 0.400-inch rod was extruded from a 2-inch billet made up of alternate wafers of Zircaloy-2 and uranium in a Zircaloy-2 sleeve. The U–2 wt. % Zr alloy billets were melted and cast in a 12-inch diameter, internally cooled, Micarta furnace. Precision density measurements were obtained on a series of extruded and swaged U–Zr alloys covering a range up to 13 wt. % Zr. Corrosion of U–2 wt. % Zr (Zircaloy-2 clad) rods was studied. (For preceding period see NMI-4353.) (W.D.M.)

1371 NMI-4355
Nuclear Metals, Inc., Cambridge, Mass.
POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period September 21, 1957 through October 16, 1957. A. M. White, P. D. Corzine, S. Isserow, and D. F. Kaufman. Oct. 25, 1957. 21p. Contract AT(30-1)-1565. $4.80 (ph OTS); $2.70(mf OTS).

The extrusion of full-scale U–Zr (Zircaloy-2 clad) tubes is described. Work on melting and casting of U–2 wt. % Zr alloy is reported. Additional corrosion information was obtained on clad rods subjected to heat treatments of varying duration at 880 or 900°C. Full-scale diffusion heat treatment of power reactor tubes is described. (For preceding period see NMI-4354.) (W.D.M.)

1372 NMI-4357
Nuclear Metals, Inc., Cambridge, Mass.
POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period November 18, 1957 through January 25, 1958. J. L. Klein, A. M. White, S. Isserow, P. D. Corzine, R. G. Jenkins, W. B. Nowak, and D. F. Kaufman. Jan. 31, 1958. 45p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. $7.80(ph OTS); $3.30(mf OTS).

The fabrication and evaluation of full-size U–Zr (Zircaloy-2 clad) tubes were continued. A technique was developed for satisfactory bright etching of tubes, but work is still required for precise measurement of the amount of cladding removed in the etch. Studies on techniques for the diffusion heat treatment were continued. It was established that 7 hrs at 880°C, followed by water quenching of the vacuum chamber in which the tube is contained, was a satisfactory heat treatment schedule. The amount of uranium that diffuses to the surface during this heat treatment is considered negligible, but the amount of creep of the Zircaloy-2 is a major problem. (For preceding period see NMI-4356.) (W.D.M.)

1373 NMI-4360
Nuclear Metals, Inc., Cambridge, Mass.
EVALUATION OF THREE ZIRCALOY-CLAD U–2% Zr FUEL TUBES. J. L. Klein. Apr. 19, 1958. 68p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. $10.80(ph OTS); $3.90(mf OTS).

Detailed and summary data obtained in the evaluation of three Zircaloy-clad fuel tubes that are considered to be candidates for irradiation at Savannah River are reported. Because of the short time available for processing these tubes, there are occasional gaps in the data. The evaluation data are presented primarily in the form of tables, both detailed and summary. Three tubes were evaluated for their suitability for irradiation at Savannah River. Items evaluated are core distribution, bond integrity, dimensions, clad thickness, straightness, surface, corrosion resistance in autoclaving, and several miscellaneous items. (auth)

1374 NMI-4361
Nuclear Metals, Inc., Cambridge, Mass.
POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period March 19, 1958 through April 11, 1958. A. R. Gilman, S. Isserow, R. G. Jenkins, D. F. Kaufman, J. L. Klein, S. R. Maloof, W. B. Nowak, and A. M. White. Apr. 8, 1958. 44p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. $9.30(ph OTS); $3.60(mf OTS).

The extrusion, etching, polishing, heat treatment, and testing of U–2 wt. % Zr (Zircaloy-2 clad) fuel tubes are described. Consistent and meaningful quantitative data were obtained on the progress of core corrosion through artificial cladding defects. Curves of hydrogen evolution vs. time, providing corrosion data vs. time, were obtained on both as-extruded and heat-treated specimens at 277°C. Yield figures were developed for the production of Zircaloy-2 billet components. (For preceding period see NMI-4359.) (W.D.M.)

1375 NMI-4362
Nuclear Metals, Inc., Cambridge, Mass.
POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period April 12, 1958 through May 6, 1958. A. R. Gilman, P. D. Corzine, S. Isserow, R. G. Jenkins, D. F. Kaufman, A. Lumbert, W. B. Nowak, and A. M. White. May 26, 1958. 24p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. $4.80(ph OTS); $2.70(mf OTS).

Microstructure examination of the interface region of the Zircaloy end seal revealed that a true metallurgical bond is produced during extrusion. The experimental extrusions, preliminary to the 9-tube prototype program, have been successfully carried out on schedule at the American Brass Company. Stainless steel appears to be a satisfactory support for the Zircaloy-clad tube during the diffusion heat treatment. A program was evolved for achieving smoother outer surfaces, core-cladding interfaces, and reduction of clad thinning at the end-seal taper. Further quantitative results have been obtained on the corrosion, in 530°F and 570°F water, of as-extruded and of heat-treated tubes intentionally defected. (For preceding period see NMI-4361.) (auth)

1376 NMI-4363
Nuclear Metals, Inc., Cambridge, Mass.
POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period May 7, 1958 through June 6, 1958. W. B. Nowak, P. D. Corzine, D. F. Kaufman, A. M. White, R. G. Jenkins, A. R. Lumbert, S. Isserow, and A. R. Gilman. July 8, 1958. 31p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. $4.80(ph OTS); $2.70(mf OTS).

Irregularities in the casting of U–2 wt. % Zr were resolved. Tube 13, which had been heat treated previously in direct contact with a type 304 stainless steel angle support, was autoclaved for 24 hrs in 650°F water immediately followed by 24 hrs in 750°F—1500 psi steam. No deleterious effects were observed. With improved and better controlled film developing techniques, the autoradiography was reproducible to within 0.5 mil of cladding thickness. Initial results on destructive testing indicated an accuracy within 0.5 mil on an unheat-treated sample. Corrosion in water of tubes artifically defected was studied. Some of the production costs of the tubes were determined. (For preceding period see NMI-4362.) (W.D.M.)

1377 NMI-4364
Nuclear Metals, Inc., Cambridge, Mass.
CORROSION BEHAVIOR OF DEFECTED FUEL ELEMENTS WITH U—2 w/o Zr CORE CLAD WITH ZIRCALOY-2. S. Isserow. July 21, 1958. 53p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. $7.80(ph OTS); $3.30(mf OTS).

The aqueous corrosion behavior of defected fuel elements having a U—2 wt. % Zr core with Zircaloy-2 cladding has been studied. A standard diffusion heat treatment for 7 hours at 880°C, followed by moderately rapid cooling, was established to overcome the effect of subtle defects in 15-mil Zircaloy cladding. The development of this heat treatment was carried out primarily with small rod specimens, which were also used to obtain data on auxiliary effects of the diffusion heat treatment. The heat treatment has been applied to full diameter tubes. One of these tubes was tested with subtle defects and various sections have been observed following the insertion of gross defects. These observations have shown a difference in the rate of hydrogen evolution as a result of heat treatment. In addition, the heat treatment changes the nature of failure in both full diameter tube sections and small rods. The presence of 2 wt. % Zr in the core reduces the corrosion rate considerably. Comparative quantitative data are presented for uranium alloys with various zirconium contents up to 15 wt. %. (auth)

1378 NMI-4365
Nuclear Metals, Inc., Cambridge, Mass.
EVALUATION OF ZIRCALOY-CLAD U—2 w/o Zr ALLOY TUBE NO. 19, EXTRUSION NO. 16819. J. L. Klein. July 24, 1958. 43p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. $7.80(ph OTS); $3.30 (mf OTS).

Items evaluated were: analysis of Zircaloy-2 and U—2 wt. % Zr components; extrusion conditions and observations; dimensions of core configuration; OD, ID, wall, and length dimensions; bond integrity; clad thickness; straightness; surface appearance; and corrosion behavior during high-temperature water and steam autoclaving. (W.D.M.)

1379 NMI-4366
Nuclear Metals, Inc., Cambridge, Mass.
POWER REACTOR PROGRAM. Progress Report to E. I. du Pont de Nemours and Company for the Period June 7, 1958 through July 6, 1958. W. B. Nowak, D. F. Kaufman, R. G. Jenkins, A. M. White, A. R. Lumbert, S. Isserow, and A. R. Gilman. Aug. 8, 1958. 17p. Contract AT(30-1)-1565, Sponsor Agreement No. S-31. $3.30(ph OTS); $2.40(mf OTS).

Results are given for two U—2 wt. % Zr (Zircaloy-2 clad) rods simultaneously heat treated for seven hours at 1635 ± 15°F on a type 304 stainless steel angle support. Four extrusions with various combinations of cores and end seals were carried out to investigate methods to improve tube quality, especially interface and surface smoothness. Correlation between optical and autoradiographic measurements of clad thickness was carried out by destructive examination. (For preceding period see NMI-4363.) (W.D.M.)

1380 NP-6985
MSA Research Corp., Callery, Penna.
PROGRESS REPORT NO. 48 FOR AUGUST AND SEPTEMBER 1958. W. J. Posey, ed. Oct. 16, 1958. 22p. Contract NObs-65426.

The film boiling loop is being repaired before the new test program is started. The preliminary test schedule for film boiling with water inside tube is presented. Tests are being conducted to evaluate application of protective coatings to stainless steel pipe to prevent chloride stress corrosion. Inconel pipe is being investigated as an alternate piping material. Inconel pipe has not cracked under conditions which have produced cracks in stainless steel pipe specimens. One fission product release run in steam with a low input rate and without water in the bottom of the vessel was completed. Analytical techniques for detecting Cl^- at < 100 ppb concentrations in water are being studied with particular application to boiler, condenser, and fuel water systems of high-pressure, high-temperature power reactor systems of submarines. (For preceding period see NP-6932.) (W.L.H.)

1381 NP-6998
Buffalo. Univ.
PROGRESS REPORT NO. 4 [FOR] JULY 1, 1958 TO SEPTEMBER 30, 1958. J. F. Andrew, J. Repetski, H. E. Strauss, D. C. Wobschall, and S. Mrozowski. 13p. Contract AF33(616)-5186.

Measurement of Young's modulus was made on a graphite ½-in.-diam. rod for eight different directions of bending. Additional attenuation measurements were made on carbon rods. An effort was made to determine the cause of variance of the thermal conductivity as evidenced upon repeated heating and cooling of the carbon test specimens. (W.L.H.)

1382 NP-7015
Rensselaer Polytechnic Inst., Troy, N. Y.
THERMOGRAVIMETRIC AND CORROSION STUDIES, AND PHASE EQUILIBRIA FOR LITHIUM, SODIUM AND POTASSIUM CARBONATES. Technical Report No. 2. Max R. Lorenz and George J. Janz. Oct. 1958. 29p. Project No. 441-35. Contract Nonr-591-(10).

Results of thermogravimetric studies on lithium and potassium carbonate in vacuum and in an atmosphere of CO_2 up to 600°C are reported. Corrosion studies including tests on platinum, silver, gold, boron nitride, and single crystals of magnesium oxide are described. Silver, gold, and single crystal magnesium oxide show little evidence of corrosion when in contact with molten carbonates at temperatures up to 1000°C. A report on studies in progress of the phase equilibria for the ternary system $Li_2CO_3-Na_2CO_3-K_2CO_3$ is given together with the equilibrium diagrams for the three possible sets of binary mixtures for these carbonates. (auth)

1383 NP-7029
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
PREPARATION OF LARGE METALLIC SINGLE CRYSTALS FOR NEUTRON DIFFRACTION. A. Modrzejewski, B. Buras, and R. Czarnecki. Aug. 1958. 12p.

Large single crystals of zinc, lead, aluminum, and copper are grown by slow cooling of the melt. They are oriented by means of x rays, cut mechanically, and then etched chemically. The planes are about 45 mm wide and 120 mm long with a mosaic spread of about 1 to 10 minutes of arc. (auth)

1384 NRL-5206
Naval Research Lab., Washington, D. C.
A PROPOSED MECHANISM FOR THE STRENGTHENING OF SAP-TYPE ALLOYS. G. S. Ansell. Aug. 19, 1958. 5p. Project NR-510-000.

Wrought materials produced from sintered and extruded flake metal powders (SAP-type alloys) containing a finely dispersed stable second phase possess enhanced elevated temperature properties. Based upon an extension of the results found in investigating the creep properties of the MD 2100 aluminum SAP-type alloy, it is proposed that the extrusion process causes motion of the grain boundaries, sweeping dislocation sources into the vicinity of the second phase, where they are pinned in place and no longer active. Since high stresses are necessary to nucleate dislocations from other than normal dislocation sources, the observed higher yield strengths and lower ductilities common to these alloys are to be expected. The SAP-type alloys therefore are not dispersion hardened alloys in the usual sense, since normal dislocation sources in these alloys would be active, with the dispersed second phase acting only to hinder dislocation movement. If the manufacturing process of the SAP-type alloys were adjusted so that only some of the dislocation sources were pinned, it is assumed that alloys with high temperature tensile properties superior to those of the normal dispersion hardened alloys could be obtained without extreme loss of ductility. (auth)

1385 NYO-7921
Aeroprojects, Inc., West Chester, Penna.
APPLICATION OF ULTRASONIC VIBRATION TO THE COMPACTION OF METAL POWDERS. J. G. Thomas and J. B. Jones. June 1958. 41p. Contract AT(30-1)-1836. $6.30(ph OTS); $3.00(mf OTS).

Although powder metallurgy has lent impetus to the fabrication of high-performance materials for nuclear reactor components, problems are associated with the technique; and the feasibility of applying ultrasonics as a means of improving and simplifying powder metallurgy procedures was investigated. Consideration was given to the possible influence of ultrasonic vibratory motion on mold filling, compact forming, and compact ejection, with the view of improving the density, uniformity, and strength of unsintered compacts. Suitable equipment was devised, utilizing force-insensitive mounting systems to introduce ultrasonic vibration into the material being compacted while under pressure up to 70 tons per square inch. The effectiveness of the mounting system and the vibratory system designs for activating both the die walls and the punches was demonstrated. Three methods of applying vibratory energy were used: axial vibration of the punch, lateral vibration of the punch, and vibration of the die in a bell mode pattern. The last proved most effective. Six different metallic powders were examined, but most of the compacts were prepared from hydrogen-reduced iron powder. With this readily compacted material, a small but significant increase in as-pressed density was observed when the die was vibrated ultrasonically. Carbonyl nickel, 70 to 30 brass, and a mixture of 85% tungsten carbide and 6% cobalt also indicated increased density. Mold fill was facilitated by ultrasonic application to the die during fill, thereby increasing the density of the powder before pressing by a factor of approximately 30%. (auth)

1386 ORNL-2406
Oak Ridge National Lab., Tenn.
THE RECRYSTALLIZATION AND GRAIN GROWTH OF INCONEL. D. A. Douglas and J. R. Weir. Nov. 20, 1958. 29p. Contract W-7405-eng-26. $1.00(OTS).

The results show the wide temperature range over which recrystallization of Inconel is possible. It appears that a temperature of 1700°F will obtain recrystallization of all worked structures regardless of the severity, but that the resulting final grain size, at least for short exposures, will depend on the degree of prior cold work. When the material has a coarse-grain size prior to deformation, a somewhat higher temperature for recrystallization is required. Also, the carbides in the grain boundaries of the worked, coarse-grain material remain fixed when recrystallization occurs so that the new grains do not receive the usual contribution to their creep resistance from such particles. Thus it can be assumed that the mechanical properties of such a structure would be inferior to material of a similar grain size, but with the carbides more favorably situated. This mixed structure is still found in some cases after a 2-hr anneal at 1800°F, and therefore is not completely eliminated until treated at 1900°F. Finally, it appears to make little difference to the grain size resulting from a 1900°F anneal, whether the material was initially fine or coarse grain, or the degree of prior cold work to which it was subjected. (auth)

1387 ORNL-2582
Oak Ridge National Lab., Tenn.
THE EFFECT OF SIMULATED WELD THERMAL CYCLES ON THE PROPERTIES OF HASTELLOY B. Ernest G. Thompson. Oct. 28, 1958. 70p. Contract W-7405-eng-26. $10.80(ph OTS); $3.90(mf OTS).

The effects of weld thermal cycles in the temperature range 1500 to 2400°F on the properties, and microstructure of the weld heat-affected zone of Hastelloy B were investigated. Through the use of a time-temperature controller and a hydraulic-mechanical testing device, specimens of a size suitable for study were subjected to simulated weld thermal cycles and fractured at various points during these cycles. Reduction-in-area, load, and strain measurements were taken and the results correlated with microstructural changes occurring as a result of the thermal cycles involved. The as-received structure of the material was found to be a nickel-rich solid solution of molybdenum (α) and a single secondary phase concluded to be an intermetallic compound NiMo (δ). Hastelloy B suffered no impairment of its ductility properties as a result of thermal cycles up to 2250°F in maximum temperature. At 2300°F the material began to lose its ductility and at 2350°F and 2400°F it was, to all intents, completely brittle. Specimens of Hastelloy B were tested during the cooling portion of 2300, 2350, and 2400°F thermal cycles. The peak temperature of 2300°F was found to cause no impairment in the ductility of Hastelloy B at lower temperatures, the 2350°F peak temperature caused permanent injury to the material in the range of 2300°F, and the 2400°F peak temperature was found to injure the material slightly from 1800 to 2000°F and to embrittle it severely at higher temperatures. No unusual effects were noted from tensile strength measurements and only the 2400°F thermal cycle affected this property, causing about a 10% loss in tensile strength at all testing temperatures. Strain measurements were found to be insensitive as a measure of the effect of weld thermal cycles on the material. The loss in ductility at high temperatures for a thermal cycle involving a maximum temperature of 2350°F was attributed to the formation of grain-boundary films. The severe loss in ductility and mild loss of tensile strength as a result of the 2400°F thermal cycle was concluded to be caused by the formation of a eutectic along the grain boundaries of the material. (auth)

1388 ORNL-2619
Oak Ridge National Lab., Tenn.
THE FAILURE OF STRUCTURAL METALS SUBJECTED TO STRAIN-CYCLING CONDITIONS. R. W. Swindeman and D. A. Douglas. Nov. 7, 1958. 20p. Contract W-7405-eng-26. $3.30(ph OTS); $2.40(mf OTS).

Data showing the isothermal strain-cycling capacity of three metals, Inconel, Hastelloy "B," and beryllium, are presented. It is noted that at frequencies of 0.5 cycles per minute the data satisfied an equation of the form $N^{\alpha}\epsilon_p = K$, where N is the number of cycles to failure, ϵ_p is the plastic strain per cycle, and α and K are constants whose values depend on the structure and test conditions. Data on Inconel are given to establish the effect of grain size, specimen geometry, temperature, and frequency. It is found that at temperatures above 1300°F, grain size and frequency exert a pronounced effect on the rupture life. Fine-grained metal survives more cycles before failure than coarse-grained material. Long time cycles shorten the number of cycles to failure when the strain per cycle is low. Thermal strain cycling data for Inconel are compared to strain cycling data at the same mean temperature. Good correlation is found to exist between the two types of data. (auth)

1389 SEP-249
Sylvania Electric Products Inc. Research Labs., Bayside, N. Y.
DIMENSIONAL INSTABILITY OF URANIUM—III. Third Annual Progress Report for June 30, 1957 to June 30, 1958. R. Resnick, L. S. Castleman, and L. Seigle. June 30, 1958. 19p. Project No. 1571. Contract AT(30-1)-2102. $0.75(OTS).

The mechanism of dimensional instability of uranium is under investigation. In order to confirm an assumption of the diffusion theory, the magnitude of diffusion anisotropy in alpha-uranium single crystals is being determined by measurement of the self-diffusion coefficients along principal crystallographic directions. Initial measurements have yielded values of 5×10^{-15} cm^2/sec along the [010] and 4×10^{-15} cm^2/sec along the [001]. These values are being rechecked. In addition, in-pile experiments designed to further clarify the effect of grain size on growth under irradiation have been initiated. (For preceding period see SEP-246.) (auth)

1390 WADC-TR-55-463(Pt. II)
Martin Co., Baltimore.
DEVELOPMENT OF BRAZED SANDWICH CONSTRUCTION MATERIALS FOR HIGH TEMPERATURE APPLICATIONS. Period covered: February 15, 1956 to August 15, 1957. Charles F. Burrows and F. J. Ragland, Jr. Oct. 1957. 115p. Project title: METALLIC MATERIALS. Task title: WELDING, BRAZING, AND SOLDERING OF METAL. Contract AF33(616)-2602. (AD-155725).

An investigation was undertaken to study various base metal—braze alloy combinations for honeycomb sandwich structures that would have utility up to a maximum temperature of 1200°F. The base alloys, 17-7PH, 422, A286, 19-9DL,,and 17-14 Cu Mo were evaluated with silver and nickel base brazing alloys to determine their compatability and strength characteristics to develop an optimum sandwich combination. On the basis of brazing studies and structural tests, it was found that A286 corrosion resistant steel brazed with a nickel-chromium-silicon-iron-boron alloy offered the optimum sandwich construction for operating temperatures of 1000 to 1200°F. Static flexure and edgewise compression data are given for all optimum base metal—braze alloy combinations. S/N curves for flexural fatigue studies made at temperatures of 75, 500, and 1000°F are presented for the A286 with Ni-Cr-Si-Fe-B optimum sandwich combination. (auth)

1391 WADC-TR-56-400(Pt. I)
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
THERMAL PROPERTIES OF MATERIALS. PART I. PROPERTIES OF GRAPHITE, MOLYBDENUM AND TANTALUM TO THEIR DESTRUCTION TEMPERATURES. Period Covered: March 1955 to June 1956. N. S. Rasor and J. D. McClelland. Oct. 26, 1956. 58p. Project No. 2998. Contract AF33(616)-2909. (AD-118144).

Deleted version of the classified report AI-1672(Pt. I) bearing WADC-TR-56-400(Pt. I) as a secondary number.

Thermal expansion, specific heat, and thermal conductivity were determined from 2000°F to near the destruction temperature of molybdenum (M.P. 4700°F), tantalum (M.P. 5400°F), and four types of graphite (sublimes at 6600°F). To obtain and measure the temperatures required, a carbon tube furnace, a carbon helix furnace, and a photoelectric pyrometer were developed. The details of their construction and use are described. The thermal expansion data for the materials investigated show no grossly unusual features. The specific heat of the metals, particularly molybdenum, appreciably exceeded the Dulong-Petit value. However, their thermal conductivities closely followed the Lorenz (Wiedemann-Franz) relation for free electrons. At intermediate temperatures (2000 to 5000°F) the thermal conductivity and specific heat of graphite show no unusual features. However, at higher temperatures large and abrupt increases in specific heat and thermal resistivity occur which are consistent with the occurrence of thermally produced vacant lattice sites. A vacancy concentration of about 0.4 at.% at the sublimation temperature, and a formation energy in the vicinity of 7 ev are indicated. (auth)

1392 WADC-TR-58-164(Pt. I)
National Bureau of Standards, Washington, D. C.
OXIDATION OF EXPERIMENTAL ALLOYS. Period covered: March 1, 1956 to November 30, 1957. Joseph C. Richmond and H. Richard Thornton. May 27, 1958. 53p. Project title: GENERAL ELECTRIC CYCLE AIRCRAFT NUCLEAR PROPULSION SUBSYSTEM FOR SYSTEM DEVELOPMENT. Task title: GENERAL ELECTRIC ANP MATERIALS. Contract AF33(616)-56-19. (AD-155688).

A study was made of the oxidation resistance of ten high-temperature alloys: (1) aluminum-modified Nichrome V, (2) Nichrome V, (3) niobium-modified Nichrome V, (4) an iron—chromium—aluminum alloy, (5) Inconel 702, (6) Hastelloy R235, (7) Hastelloy W, (8) type 316 stainless steel, (9) Inconel X, and (10) Inconel. Tests included the measurement of the average depth of external oxidation and maximum depth of oxide penetration on specimens that had been subjected to stress in air at high temperature for 100 hours, and on specimens that had been subjected to stress in air under fluctuating-temperature conditions for an equivalent length of time, plus continuous recording of the weight change of specimens oxidized in air at high temperatures. The depth of oxidation was found to increase with temperature and with stress. There was little effect of stress at stresses below that required to produce 1% extension in 100 hours. All of the alloys conformed reasonably well to the parabolic rate law in the weight-gain oxidation tests. (auth)

1393 WAL-401/257
Syracuse Univ., N. Y. Research Inst.
EFFECT OF INTERSTITIALS UPON THE DEFORMATION AND FRACTURE CHARACTERISTICS OF TITANIUM. STRESS-STRAIN RELATIONS IN TITANIUM AND TITANIUM ALLOYS. Final Report. E. P. Klier and C. Gazzara. Aug. 1958. 251p. DA Project No. 593-08-021. Contract DAI-30-115-505-ORD-686. (MET-410-588F).

The plastic flow properties of three basic titanium alloys, pure titanium, 5% aluminum—titanium, and 6.5% manganese—titanium at three levels of concentration of the interstitial additives oxygen, carbon, nitrogen, and hydrogen as a function of four constant strain rates and five levels of constant ambient temperature between −320 and 75°F were studied. The stress-strain relationships under the imposed test conditions were analyzed on the basis of the power law $\sigma = \sigma_0\delta^n$ and were found to be characterized by three regions: (1) that dominated by the yield phenomenon associated with the strain hardening exponent n_1 and strength coefficient $\sigma_{0,1}$, typified by the oxygen and nitrogen rich 6.5% Mn—titanium alloys; (2) that related to a strain hardening phenomenon describable by a second strain hardening exponent n_2 and strength coefficient $\sigma_{0,2}$, most frequently observed for all alloys tested; and (3) an intermediate strain region, represented by an overlapping of the two stress-strain curves, relative to regions (1) and (2) promoting a maximum intermediate stress and observed primarily in the 6.5% Mn—titanium alloys. The dependency of variables pertinent to an investigation of plastic flow phenomena such as yield strength, tensile strength, ductility, n_1, n_2, $\sigma_{0,1}$, $\sigma_{0,2}$, elongation, natural strain at maximum load on the testing variables was determined and is reported. (auth)

1394 WAL-410/1
Rensselaer Polytechnic Inst., Troy, N. Y.
AGING EFFECTS IN TITANIUM ALLOYS. Final Report. D. J. Lam, M. F. Gendron, R. R. Nash, and A. A. Burr. May 1958. 106p. DA Project No. 593-08-021. Contract DA-30-115-505-ORD-687.

The quench aging response of a series of Ti—Mn, Ti—V, and Ti—Cr binary alloys was investigated. These alloys were solution heat treated in the alpha-beta phase region, with the exception of Ti—16 Cr and Ti—18 Mn, to avoid beta embrittlement. Aging temperatures were chosen to avoid omega formation. The data presented show the effects of aging temperature and time on the tensile, impact, hardness, electrical resistivity, and in some cases modulus of elasticity properties. Results indicate that a good combination of strength and ductility can be obtained for titanium binary alloys whose alloy content is less than 8%, on aging for short times at 900°F. With higher alloy contents the same holds true for the Ti—V system. For a higher manganese content aging should be carried out at higher temperatures. The Ti—Cr alloys were found to be very unstable. (auth)

1395 WAPD-A1W(M)-1125
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
A1W METALLURGY BRAZING STATUS REPORT. R. E. Droegkamp and R. M. Stackhouse. Jan. 27, 1958. 33p. $6.30(ph OTS); $3.00(mf OTS).

Extensive studies of candidate alloys for brazing Zircaloy to Zircaloy led to the selection of Zircaloy-2—4 wt. % Be alloy as the best brazing material from the standpoints of mechanical and hot water corrosion properties. The development work on this alloy is described, and the direction of future work is indicated. (D.E.B.)

1396 WAPD-IPC-449
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
RESULTS OF X-3-e METALLOGRAPHIC EXAMINATION. K. Katz. [Feb. 1957]. Decl. June 13, 1958. 7p. $1.80(ph OTS); $1.80(mf OTS).

The X-3-e test is the first in-pile nucleate boiling test to be studied for cladding corrosion. The samples reported on were all in the nucleate boiling zone. Results show that the corrosion rate is not affected by nucleate boiling when compared with the established Zircaloy-2 rate equations. (W.L.H.)

1397 WAPD-ZH-11
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
ZIRCONIUM HIGHLIGHTS. Oct. 1958. 20p. Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

Studies were made of the creep properties of cold-swaged and cold-swaged and base-annealed Zircaloy-2 and -3. Several differences observed in the two conditions were examined. Further work was done in an attempt to identify the source of inclusions found previously in some vacuum melted Zircaloy-2 after routine corrosion tests. This work is summarized. Results from studies of the effects of impurities on the corrosion and mechanical properties of vacuum melted Zircaloy-2 are reported. The impurities considered were Al, Cu, Mn, N, and Si. A method is described for removing residue iron contamination from Zircaloy surfaces. Zirconium sponge and Zircaloy-2 ingots were analyzed by fluorimetric chemistry to determine the content of naturally occurring uranium. Results are tabulated. (For preceding period see WAPD-ZH-10.) (D.E.B.)

1398 AEC-tr-3445
[PHASE STUDIES OF Pd—In, Pt—Ga, Ni—Ga, Ni—In, Cu—In AND Ag—In SYSTEMS. REPORT OF X-RAY INVESTIGATIONS.] E. Hellner and F. Loves. Translated by S. E. Piel (Westinghouse Electric Corp. Bettis Atomic Power Div.) from Z. Naturforsch. 2a, 180-1(1947). 4p.

Phase studies of the following alloys are presented: Pd—In, Pt—Ga, Ni—Ga, Ni—In, Cu—In, and Ag—In. (W.L.H.)

1399 AEC-tr-3446
THE BINARY SYSTEM SILVER—INDIUM. Erwin Hellner. Translated by S. E. Piel (Westinghouse Electric Corp. Bettis Atomic Power Div.) from Z. Metallk. 42, 17-19(1951). 6p.

The crystal structures of all phases of silver—indium alloys of the composition 25 to 80 at. % indium were determined. Phase diagrams are included, and a discussion of each phase is presented. (J.R.D.)

1400 AEC-tr-3447
CLARIFICATION OF HYSTERESIS PHENOMENA IN THE PALLADIUM–HYDROGEN SYSTEM AS WELL AS IN ROTATIONAL TRANSFORMATIONS. Carl Wagner. Translated by S. E. Piel (Westinghouse Electric Corp. Bettis Atomic Power Div.) from Z. physik. Chem. 193, 386-406(1944). 20p.

Two different phases appear when Pd is loaded with H_2 below 300°C. If both phases are presented together, a well-defined H_2 partial pressure should be found in the complete thermodynamic equilibrium at a given temperature. However, after absorption of H_2, higher pressures are observed than after H_2 withdrawal (hysteresis). In view of this, no complete thermodynamic equilibrium is actually present. It is shown that the phenomena observed can be traced back to the hindering of the exchange of Pd atoms between the phases existing side by side. An interpretation of the hysteresis phenomena in rotational transformations is given. (W.L.H.)

1401 AEC-tr-3453
EFFECT OF LOADING RATE IN TENSILE TESTS ON THE SHAPE OF THE STRESS-STRAIN CURVE. W. Engelhardt. Translated by K. S. Bevis (Savannah River Lab.) from Metall 11, 676-7(1957). 3p.

The causes of the natural yield points in ferrous metals were investigated. There are two opposing ideas at present: one explains the phenomena from the reactions in the interior, the other from reactions in the boundary region of the lattice. A definitive representation of the processes and phenomena will be involved in both areas, the lattice interior and the boundary zones. (J.R.D.)

1402 AEC-tr-3456
STUDIES ON THE EXTRUSION OF ALUMINUM ALLOYS. (FIRST REPORT) ON THE PRESSURE OF EXTRUSION. Hiroshi Asada, Eihachiro Tanaka, Kichizo Koike, and Saburo Morimoto. Translated for Savannah River Lab. from Nippon Kinzoku Gakkaishi 21, 176-83(1957). 29p.

Extrusion pressure and the form of the pressure curve for wrought aluminum alloys were investigated by an automatic recorder on 300 ton extrusion press. Aluminum alloys have a strong tendency to adhere to the working tool, and their deformation resistance varies delicately in accordance with cooling of the billet. Therefore, the initial pressure has a linear relation with the logarithmic extrusion ratio, but the pressure curves for the extrusion by direct and inverted methods into rods or tubes do not show the ideal form. The effects of extrusion speed, temperature, and soaking of billet on the extrusion pressure and the form of pressure curve were examined and discussed in connection with the results obtained. The values of resistance of extrusion at 450° for 2S, 3S, 63S, 53S, 61S, 17S, 24S, and 52S were measured as 9.39 to 6.34, 9.86 to 9.28, 11.8 to 9.8, 12.9 to 9.78, 14.5 to 12.55, 20.7 to 16.86, 24.2 to 19, 25, and 23.1 to 20.95, respectively. (auth)

1403 NP-tr-172
TOUGHENING MAGNESIUM AND ALUMINIUM BASE ALLOYS WITH TERNARY METALLIC COMPOUNDS. B. K. Vul'f and N. P. Shikalov. Translated from Izvest Sektora Fiz. Khim. Anal. Inst. Obshcheĭ Neorg. Khim. Akad. Nauk S.S.S.R. 27, 198-208(1956). 9p.

The effects of the ternary metallic compounds Al_2CuMg, $Al_2Mg_3Zn_3$, Cu_3NiAl, $Cu_2Mn_3Al_{20}$, and $Ni_4Mn_{11}Al_{60}$ on the mechanical properties of cast Al alloys were studied. Also, the effects of $Al_2Cu_4Mg_3$, $Al_3Mg_4Zn_3$, MgCuZn, $Mg_5Ca_2Zn_5$, and Al_2MgLi on the properties of pressed Mg alloys were investigated. The alloys were prepared by introducing pure metals, one at a time, or binary alloys to the molten Al or Mg, thus forming the ternary compounds. Phase diagrams are included. (J.R.D.)

1404
ON THE STRUCTURE OF URANIUM IN THIN FILM. S. N. Chatterjee (Inst. of Nuclear Physics, Calcutta). Acta Cryst. 11, 679-80(1958) Oct.

Thin film of uranium, prepared by the vacuum evaporation technique, was studied with the help of electron microscopy and electron diffraction. The analysis shows that uranium in thin film assumes the β-phase structure (tetragonal; a = 10.52, c = 5.57 A; P4nm). (auth)

1405
THE CRYSTAL STRUCTURES OF $ThHg_3$, $ThIn_3$, $ThTl_3$, $ThSn_3$, AND $ThPb_3$. Riccardo Ferro (Genoa Univ.). Acta Cryst. 11, 737-8(1958) Oct.

The alloys prepared were found to be rather oxidizable, and the ones with heavier metals appear fairly pyrophoric. This fact can be related to what happens when the thorium alloys with the heavier metal are also pyrophoric as contrasted with the more stable compounds with arsenic and antimony. (auth)

1406
X-RAY DIFFRACTION DATA FOR ANHYDROUS $BiCl_3$ AND $BiBr_3$. G. M. Wolten and S. W. Mayer (North American Aviation, Inc., Canoga Park, Calif.). Acta Cryst. 11, 739-42(1958) Oct.

X-ray-diffraction patterns of $BiBr_3$ and $BiCl_3$ show the intensities to be proportional to the area under the peaks of x-ray goniometer recordings and are calculated as percentages of the strongest line in each pattern. (auth)

1407
INVESTIGATION OF CERAMIC MATERIALS IN A LABORATORY ROCKET MOTOR. J. F. Lynch, J. F. Quirk, and W. H. Duckworth (Battelle Memorial Inst., Columbus, Ohio). Am. Ceram. Soc. Bull. 37, 443-5(1958) Oct.

Thirty-four different ceramic materials were evaluated as nozzle liners in a laboratory rocket motor employing oxygen and hydrogen as the propellants. The motor was operated with a four-to-one volume ratio of H_2 and O_2 and with a chamber pressure of 200 psia, giving a combustion temperature of about 4500°F. The specific impulse was about 265 seconds. Under these conditions, of the materials tried, ceramics of silicon carbide, zirconium boride, or beryllia, and a silicon-impregnated graphite were affected least. Functional life of the motor with the various experimental nozzles ranged from less than 15 to 107 seconds. A classification of the nozzle materials according to their functional life is given. Additional tests using different operating conditions in the test motor are recommended for firm conclusions on the merits of the materials as rocket liners. (auth)

1408
DETERMINATION OF LOW CONCENTRATIONS OF HAFNIUM IN REACTOR-GRADE ZIRCONIUM METAL AND ZIRCONIUM ALLOYS BY NEUTRON ACTIVATION ANALYSIS. W. D. Mackintosh and R. E. Jervis (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Anal. Chem. 30, 1180-2(1958) July.

Two neutron activation methods have been developed to supplement the limited means of determining low concentrations of hafnium in zirconium metal or zirconium alloys. One of the methods is simple and rapid, but must be carried out at the reactor site. The other is more involved, but can be performed at any location. The coefficient of variation is 10% at a hafnium content of 60 to 120 ppm. The sensitivity is at least 70 ppm., the level found in the best samples available, but is deduced to be 10 ppm. (auth)

1409

STAINLESS ALLOYS, PRESENT AND FUTURE. W. O. Binder (Electro Metallurgical Co., Niagara Falls, N. Y.). Chem. Eng. Progr. 54, No. 11, 45-50(1958) Nov.

The corrosion and metallurgical properties of stainless steels are discussed, and the properties of new stainless steels and high alloys are given and compared. Included in the discussion of properties are: stress-corrosion cracking and its prevention; effect of sigma- and chi-phase precipitation on strength, ductility, and corrosion; intergranular corrosion and its prevention; and hot-shortness during welding. The new stainless steels described are: high-manganese, precipitation-hardening, special high alloy (high Ni, with Mo, Cu, and Si), and ferritic high-temperature. High alloys such as Inconels, Alloy 805, Nimonics, Waspaloy, Udimet, Incoloy, Illium R and G, Ni—O—Nel, and Hastelloys are briefly discussed. Corrosion data from types 202 and 300 stainless steels in about 30 different chemical plant environments are tabulated. (T.R.H.)

1410

CERAMIC MATERIALS FOR HIGH-TEMPERATURE APPLICATIONS IN THE CHEMICAL PROCESS INDUSTRIES. M. Jack Snyder (Battelle Memorial Inst., Columbus, Ohio). Chem. Eng. Progr. 54, No. 11, 65-6(1958) Nov.

Recently developed high-temperature processes (above 1500°C) which require ceramic containment and the ceramic materials used are discussed. Tables showing upper operating temperatures of commercial ceramics and pure compounds and their uses and limitations are given. (T.R.H.)

1411

THE FINE STRUCTURE OF THE X-RAY ABSORPTION K SPECTRA OF TITANIUM IN CARBIDES. E. E. Vainshtein, I. B. Staryi, and E. A. Zhurakovskii (Ushinskii, Odessa Pedagogical Inst.). Doklady Akad. Nauk. 122, 365-6(1958) Sept. 21. (In Russian)

Additional data are given on titanium absorption K spectra in Ti—C systems with carbon contents of 12 to 24 wt. %. Diagrams are presented of the x-ray K spectra and $K\beta_5$ line of titanium emission in carbides with various carbon contents and of the juxtaposition of x-ray K spectra for titanium absorption in carbide and rutile. (R.V.J.)

1412

INTERACTION BETWEEN ATOMS IN IRON—CHROMIUM ALLOYS. A. G. Lesnik (Inst. of Metal Physics, Academy of Sciences, USSR). Doklady Akad. Nauk. 122, 385-8 (1958) Sept. 21. (In Russian)

It is shown that in the statistical theory of alloys the hypothesis of a polar atomic state in alloys leads to the comprehension of the basic aspects of solid solution decomposition with segregation of various composition intermetallic compounds of σ phase. (R.V.J.)

1413

THE ROLE OF MICRO-ORGANISMS IN CERTAIN CORROSION PHENOMENA. Lucien Baudon. Ind. chim. belge 23, 983-90(1958) Sept. (In French)

A brief survey is presented of the electro-chemical theory of corrosion. It is shown that the corrosion phenomena in which microorganisms play a role are connected to this theory. The different species of bacteria causing corrosion in ferrous and non-ferrous metals are described, and their actions are interpreted. The means of protections against such biologic corrosions are enumerated. (tr-auth)

1414

MAGNETIC CORE MATERIALS. Iron Age 182, No. 16, 190-1(1958) Oct. 16.

A review of the composition, treatment, and uses of magnetic materials is presented. The classification of magnets and their characteristics is tabulated. (J.R.D.)

1415

CAST ALLOYS RESIST HEAT. Iron Age 182, No. 16, 192-4(1958) Oct. 16.

The composition, uses, and alloy casting institute identification of nickel—chrome cast alloys are described, including some alloys recommended for use at temperatures of 2000°. (J.R.D.)

1416

CASTINGS WITHSTAND CORROSION. Iron Age 182, No. 16, 194-5(1958) Oct. 16.

Cast stainless alloys are designed primarily to resist corrosive media and are intended for operation below 900°F. The composition, process treatment, and uses of these alloys are described. (J.R.D.)

1417

NEW PLANT FOR REFRACTORY METALS WILL FEATURE INERT ATMOSPHERE. Iron Age 182, No. 20, 148-9(1958) Nov. 13.

A pilot plant to fabricate molybdenum, niobium, tungsten, rhenium, and tantalum is being built. The plant's airtight enclosure measures 40 × 80 × 25 ft and is filled with 99.995% argon. The atmosphere will allow hot working of the metals at 3000 to 5000°F. (J.R.D.)

1418

EVALUATION OF TENSILE, COMPRESSIVE, TORSIONAL, TRANSVERSE, AND IMPACT TESTS AND CORRELATION OF RESULTS FOR BRITTLE CERMETS. Matthew J. Kerper, Lewis E. Mong, Maurice B. Stiefel, and Sylvanus F. Holley. J. Research Natl. Bur. Standards 61, 149-69(1958) Sept.

Static tests were studied for the determination of mechanical properties of brittle materials. Specimens of brittle materials, represented by cermets having five different compositions, were subjected to tensile, compressive, torsional, transverse, and impact tests. The designs of specimens and apparatus, suitability of the tests to the materials, refinements in test procedures, and the variability of results and their correlation were studied. The elastic properties were obtained from tensile, compressive, and transverse tests, and the modulus of rigidity calculated from the results of these tests agreed with that from the torsional tests. Tensile strength was obtained from the tensile, torsional, and transverse tests on specimens of comparable sizes in accordance with a limiting tensile strain. Shear strengths were obtained in the compressive tests. The correlation of impact values with mechanical properties was unsatisfactory. (auth)

1419

PROCESS OF THE METALLOGRAPHIC ATTACK OF URANIUM. M. Englander, J. Stohr, and J. Laniesse (Centre d'Etudes Nucleaires Saclay, France). Le vide No. 69, 215-19(1957) May-June. (In French)

A new method of obtaining colored films by oxidation in the gaseous state is described. All the details of the microstructure are revealed by this method. The method was applied to many uranium samples with good results and may be applied to other metals. (J.S.R.)

1420

PREVIEW OF SPACE METALS. Metal Progr. 74, No. 4, 96-113(1958) Oct.

The present state of development and the prospects of future developments of Al, Mg, steels, Ti, Be, superalloys, refractory metals, ceramics, sandwich construction, surface treatment, and coatings are examined. (J.R.D.)

1421

THE DEVELOPMENT OF BERYLLIUM FOR NUCLEAR REACTOR APPLICATIONS. G. C. Ellis (Atomic Weapons Research Establishment, Aldermaston, Eng.). Metallurgia 58, 173-6(1958) Oct.

The demand for Be in reactor applications, toxic hazards, and the initial production of the metal from ore are discussed. (J.R.D.)

1422

SURFACE OXIDE FILMS AND THE BREAKAWAY CORROSION OF URANIUM. J. S. Llewelyn Leach (Imperial Coll., London). Nature 182, 1085-6(1958) Oct. 18

Preliminary results are reported from a study of the protective effects of surface oxide films against the corrosion of uranium. By measuring the electrical and leakage resistance, an estimate is made of the thickness and conductivity of the oxide film. The influence of the properties of the surface film on breakaway corrosion of uranium is discussed. (C.H.)

1423

A NEW APPROACH TO THE INVESTIGATION OF THE CAUSE OF MOISTURE EXPANSION OF CERAMIC BODIES. Thaisa Demediuk and W. F. Cole (Commonwealth Scientific and Industrial Research Organization, Victoria, Australia). Nature 182, 1223-4(1958) Nov. 1.

Moisture expansion of low-burnt ceramic bodies can be due to the rehydration of anhydrous clay minerals, and that of high-burnt bodies to the rehydration of glass. Results of studies are presented which demonstrate that amorphous alumino-silicates, amorphous silica, and γ-alumina can also play an important part in moisture expansion, depending upon the composition of the body and the firing temperature. (C.H.)

1424

EFFECT OF HEAT TREATMENT ON THE SINTERING OF 'ACTIVE' CERAMIC OXIDE POWDERS. D. T. Livey and P. Murray (United Kingdom Atomic Energy Authority, Harwell, Eng.). Nature 182, 1362(1958) Nov. 15.

Compacts made from beryllium oxide prepared by calcining the hydroxide to 1,250°C were found to sinter to bulk densities of 27% porosty if rapidly heated to 1,600°C in one hour. When similar compacts were heat-treated for several hours at 1,300 to 1,400°C prior to the temperature being raised to 1,600°C, bulk densities of 8% porosity were obtained. Explanations of this effect are discussed. (C.H.)

1425

GOLD-MANGANESE ALLOYS, SOME PRELIMINARY STUDIES BY NEUTRON DIFFRACTION. G. E. Bacon (Atomic Energy Research Establishment, Harwell, Berks, Eng.) and R. Street (Univ. of Sheffield, Eng.). Proc. Phys. Soc. 72, Pt. 3, 470-4(1958) Sept. 1.

Meyer and Taglang (1956) showed that the alloy Au_2Mn, which is antiferromagnetic in zero and weak magnetic fields, becomes ferromagnetic when a magnetic field above a certain threshold value is applied. The saturation magnetization corresponds to a moment of 3.49 μb per manganese atom. Meyer (1956) has described a ferromagnetic form of $MnAu_4$ bearing a magnetic moment of 4.15 μb per manganese atom, suggesting that the manganese is in an ionic form. Neutron diffraction techniques were used to study the gold—manganese system. A preliminary account of the results of the study is given. (A.C.)

1426

ION PHASE MEASUREMENTS ON THE BIRMINGHAM CYCLOTRON. M. Konrad (Univ. of Birmingham, Eng.). Rev. Sci. Instr. 29, 840-5(1958) Oct.

The ion phase in the internal beam of the Birmingham cyclotron at distances from the ion source from 8 mm up to 69 cm was determined by measurements of the target current waveform. The equipment consisted of a screened target and a specially built oscilloscope based on the sampling technique. The results obtained are discussed and compared with theory. Ions are grouped in phase at early stages of acceleration over approximately 20 electrical degrees, which is about 5 times larger than predicted by the uniform electric field approximation. At later stages the measured phase changes are in good agreement with Rose's equation. (auth)

1427

INVESTIGATION OF EROSION AND CORROSION OF TURBINE MATERIALS IN WET OXYGENATED STEAM. H. A. Cataldi, C. F. Cheng, and V. S. Musick (General Electric Co., Schenectady, N. Y.). Trans. Am. Soc. Mech. Engrs. 80, 1465-78(1958) Oct.

Steam from the boiling water reactor of the Dresden Nuclear Power Station will enter the turbine at 869 psia and 525°F with ½ % moisture and with oxygen concentration higher than normal in power-plant practice. This paper discusses a series of preliminary laboratory tests evaluating the resistance of various materials for turbines and related components to erosion (impact, washing, wire-drawing) and corrosion (weight loss, pitting depths, crevice, and galvanic attack) in wet, oxygenated steam. Materials tested included carbon and low-alloy steels and cast iron, austenitic and ferritic stainless steels, Monel, cupronickels, leaded bronze, Stellite, and Ductile Ni-Resist No. 3. It is concluded that, with proper design, conventional materials may be used in the Dresden turbine except in a few critical areas. (auth)

1428

THE WELDING OF SOME NONFERROUS AND FERROUS TUBES TO TUBE SHEETS. R. W. Bennett (Alco Products, Inc., Schenectady, N. Y.). Welding J. (N. Y.) 37, 1071-80(1958) Nov.

A discussion of metallurgical and welding considerations related to the welding of Monel, copper, copper—nickel alloys, copper—zinc alloys, and stainless steel tubes to tube sheets of the same material or carbon steel is presented. The joining technique applies to construction of high-pressure feed water heaters for the steam power industry and of special types of heat exchangers used for atomic power and chemical process applications. (J.R.D.)

1429
LITHIUM AND ITS COMPOUNDS. D. S. Laidler. *Roy. Inst. Chem. (London) Lectures, Monographs, Repts.* No. 6, 35p(1957).

A survey of lithium and its compounds is presented. The monograph includes discussion of factual material on principal ores, manufacturing processes, and the properties and uses of lithium metal, alloys, and compounds. 68 references. (J.R.D.)

1430
CAUSES AND PREVENTION OF CORROSION IN AIRCRAFT. T. C. E. Tringham. London, Sir Isaac Pitman & Sons, Ltd., 1958. 129p. $5.75.

The sources of corrosion in the manufacturing processes of aircraft are described. Storage procedures for raw materials and finished parts are presented. Causes of corrosion in aircraft in service are reviewed. The causes and prevention of corrosion in engines and their associated components are described. Corrosion in aircraft electrical equipment is described. Methods of cleaning metals prior to electroplating are reviewed. Electroplating processes for various metals are discussed. The anodic oxidation of aluminum and chromating of magnesium is discussed. The principal uses of the metallizing processes in the aircraft industry is to provide a protection against heat and corrosion on engine exhaust system components and such items. The pre-treatments of various metals prior to painting are presented. The application of paints, enamels, varnishes, and resins for protecting aircraft components is discussed. The examination of aircraft parts and structures for defects by one or more of the non-destructive processes is discussed. The salvage of aircraft components from water is discussed. (W.L.H.)

1431
METALS FOR SUPERSONIC AIRCRAFT AND MISSILES. Proceedings of the Conference, Heat Tolerant Metals for Aerodynamic Applications, held January 28 and 29, 1957 at the University of New Mexico, Albuquerque, New Mexico. D. W. Grobecker, ed. Cleveland, American Society for Metals, 1958. 436p.

The basic problem of the thermal barrier and its importance in the selection of structural materials for aircraft are presented. Since materials alone cannot provide solutions to all thermal problems, various design expedients must be combined with careful selection of materials. These include the use of refrigeration, insulation, transpiration cooling, and other methods. The environmental conditions are discussed to which the surface of a metal used in aerodynamic application is subjected as a result of gas pressure, heat flux, gas composition, and flow patterns. A review of the properties required and testing techniques for metals for use in aerodynamic applications are presented. The kinetics of oxidation of unalloyed metals in a gas stream with aerodynamic heating are presented. Surface deterioration defeats the purpose for which metals with desired bulk properties or heat absorbing capacity are used. Protecting these structural materials with surface coating of a more refractory material is the problem discussed. The use of the light metals (Al, Mg, and Ti) in aircraft is discussed. The use of AlSi and stainless steels in aerodynamic applications is discussed. The application of cobalt- and nickel-base alloys in aircraft other than heat energies is discussed. A brief review of the physical and mechanical properties and the temperature ranges of these alloys is presented. Eleven elements not customarily used for structural purposes but which possess properties which might make them of interest for aerodynamic applications are discussed. The eleven elements are Cr, Nb, Hf, Ir, Mo, Os, Rh, Ta, W, V, and Zr. A review of the principles of powder metallurgy and three principal applications of powder metallurgy techniques is presented. The numerical data on oxides, carbides, borides nitrides, silicides, titanides, cermets, and intermetallic compounds are summarized in a series of tables and illustrations. (W.L.H.)

1432
THE METAL MOLYBDENUM. Proceedings of a Symposium sponsored by The Office of Naval Research, Department of the Navy, held September 18 and 19, 1956 at Rackham Memorial Building, Engineering Society of Detroit, Detroit, Michigan. Julius J. Harwood. Cleveland, American Society for Metals, 1958. 703p.

The first section of this volume discusses the future of Mo and its alloys along with the properties and applications of commercial Mo and Mo alloys. The second section discusses the preparation and fabrication of Mo and its alloys. The third section discusses the metallurgy of Mo and Mo-base alloys. The fourth section discusses the application of Mo alloys for gas turbines. The last section reviews European developments of Mo. (W.L.H.)

PARTICLE ACCELERATORS AND HIGH-VOLTAGE MACHINES

1433 CEA-743
France. Commissariat à l'Énergie Atomique, Paris.
PHÉNOMENÈS MAGNÉTIQUES DANS LES CYCLOTRONS F.F.A.G. (Magnetic Phenomena in F.F.A.G. -cyclotrons.) R. Beurtey. 1957. 17p.

This study regroups and develops some experimental and theoretical results obtained with spiral tract cyclotrons. The main useful results, which are in accordance with the rather scarce experimental results obtained on spiral pole pieces, are given. (auth)

1434 MURA-200
Midwestern Universities Research Assn., [Madison, Wis.] and University of Notre Dame, Notre Dame, Ind.
NON-LINEAR RESONANCES IN ALTERNATING GRADIENT ACCELERATORS. G. Parzen. [Oct. 12, 1956]. 24p. Contracts AT(11-1)-384 and AT(11-1)-427. $4.80(ph OTS); $2.70(mf OTS).

A method is presented for treating the non-linear resonances which occur in the radial oscillations of the strong focussing alternating gradient type high energy accelerator. The method predicts the location of the resonances, calculates the stability limits on the amplitude of the radial oscillations, and also gives the stability limit orbit. The results of the theory are compared with those of a numerical calculation. (auth)

1435 MURA-364
Midwestern Universities Research Assn., Madison, Wis.
NOTES ON THE BERKELEY BUDKER CONFERENCE.

L. W. Jones. Sept. 9, 1957. 22p. Contract AT(11-1)-384. $4.80(ph OTS); $2.70(mf OTS).

A summary is presented of the notes taken during the last week of the discussions on Budker's suggestion that intense, moderate energy, circulating electron beams might pinch down to provide very strong local magnetic fields which might be capable of serving as guide fields for multi-Bev protons. (W.D.M.)

1436 NEVIS-33

Columbia Univ., Irvington-on-Hudson, N. Y. Nevis Cyclotron Labs.

APPLICATION OF A MECHANICAL RECTIFIER TO A CYCLOTRON. Jack Warren. Jan. 1957. 22p. Contract AT(30-1)-1932. (CU-123-57-ONR-110-1-Phys.). $4.80(ph OTS); $2.70(mf OTS).

A mechanical rectifier used as a power supply for the magnet of the Columbia University cyclotron is described. This rectifier replaces a motor-generator set formerly used as a power supply. It is the first mechanical rectifier used for this purpose. It delivers 3000 amperes at 450 volts. Eight months of operation has proved it to be a reliable and efficient power supply. (A.C.)

1437 UCRL-8334

California. Univ., Berkeley. Radiation Lab.

BEVATRON OPERATION AND DEVELOPMENT. XVII. [Period Covered]: February, March, April 1958. Walter D. Hartsough. June 26, 1958. 20p. Contract W-7405-eng-48. $0.75(OTS).

Beam evaluation was completed preparatory to a K^+-p^+ scattering experiment. The K^+ meson beam was also used to expose sixteen emulsion stacks for eight outside groups. The study of K^- mesons continued, using the liquid hydrogen bubble chamber and emulsions. Antiproton interactions were observed by using counters, the propane bubble chamber, and nuclear emulsions; p-$\bar{p}$ interactions were also observed in the hydrogen bubble chamber. Three target bombardments were made for the laboratory chemistry group and sixteen bombardments made for external groups. The rapid beam ejector was successfully operated and has been used to produce short beam pulses, 20 microseconds in duration, for bubble chamber runs. On April 23, 1958, Bevatron operation was suspended when a bolt was sheared off the armature of the east generator, resulting in abrasion and fire damage to one-third of the stator windings and in electrical arc damage to a bearing and journal. Operation is scheduled to resume on May 26, 1958, with one generator, after an inspection has been made of the east machine. The damaged generator is expected to be operable about the end of July. (For preceding period see UCRL-8261.) (auth)

1438 SCL-T-174

THE REVISION OF THE THEORY CONCERNING THE TRADEWIND CIRCULATION. (Die Revision der Lehre vom Passatkreislauf). Hermann Flohn. Translated by M. I. Weinreich from Meteorol. Rundschau 6, Nos. 1/2, 1-6(1953). 22p.

A comprehensive dynamic-thermodynamic theory of trade wind circulation is presented. The theory is in harmony with the empirical facts and contains no contradictions as to the physics of the phenomena. (C.H.)

1439

ANOMALOUS ATTENUATION IN LINEAR ELECTRON ACCELERATORS. V. J. Vanhuyse (Rijksuniversiteit, Ghent). Nature 182, 1081-2(1958) Oct. 18.

Phenomena of anomalous attenuation in a linear electron accelerator are explained on the basis of the multipactor effect. (C.H.)

1440

INAPPLICABILITY OF CERTAIN HYDROMAGNETIC PRINCIPLES TO THE IONIC CENTRIFUGE. Joseph Slepian. Phys. Rev. Letters 1, 287-8(1958) Oct. 15.

The inapplicability of the Chew, Goldberger, and Low paper on the Boltzmann equation and the one-fluid hydromagnetic equations in the absence of particle collisions in calculating the motion of isotopes in the ionic centrifuge is discussed. (W.D.M.)

1441

SYNCHROTRON PERFORMANCE WITH TWO INTERNAL TARGETS. Yu. M. Ado, T. I. Savel'ev, and B. N. Yablokov (Inst. of Physics, Academy of Sciences, USSR). Pribory i Tekh. Ekspt. No. 3, 37-9(1958) May-June. (In Russian)

Experiments were made to show that the use of two internal targets, distributed on different azimuths, considerably increases the efficiency of a synchrotron. (tr-auth)

1442

FOUR-SECTOR AZIMUTHALLY VARYING FIELD CYCLOTRON. H. G. Blosser, R. E. Worsham, C. D. Goodman, et al. (Oak Ridge National Lab., Tenn.). Rev. Sci. Instr. 29, 819-34(1958) Oct.

An electron model relativistic fixed-frequency cyclotron of the azimuthally varying field type was constructed for the purpose of testing the orbit dynamics of such a device. An iterative technique used in designing an acceptable magnetic field shape is described in some detail. A brief description of the various components of the device is given as well as an account of the beam phenomena observed in the initial period of operation. Results strongly indicate the feasibility, from an orbit dynamics standpoint, of large proton machines of this type. (auth)

1443

METHOD OF CANCELING ENERGY FLUCTUATIONS OF A VAN DE GRAAFF ION BEAM. P. B. Parks, H. W. Newson, and R. M. Williamson (Duke Univ., Durham, N. C.). Rev. Sci. Instr. 29, 834-9(1958) Oct.

A varying correction voltage is applied to the target which cancels beam energy fluctuations. This correction voltage is a known, constant multiple of a small, variable voltage which must be applied to the outer plate of an electrostatic analyzer to keep the beam centered at the analyzer image slits. The beam current at the analyzer image slits provides the signal which, when amplified by an electronic device called the Homogenizer, drives both the outer analyzer plate and the target. The energy spread is reduced to 250 ± 120 ev and is probably due only to the ion source. If the HH^+ beam is put through the analyzer, the unlimited H^+ beam also has an energy spread of 250 ev. The 1.76-Mev $C^{13}(p,\gamma)$ and 0.992-Mev $Al^{27}(p,\gamma)$ resonances were used to test performance. Our data are consistent with $\Gamma(C^{13}) = 75$ ev and $\Gamma(Al^{27}) = 100$ ev. The upper limit for the C^{13} width is 150 ev. (auth)

1444

MECHANICAL SHUTTER FOR A CYCLOTRON BEAM. Kenneth D. Jenkins and William Barclay Jones (Univ. of California, Berkeley). Rev. Sci. Instr. 29, 898-9 (1958) Oct.

A mechanical shutter is described which is internal to the cyclotron vacuum but does not disrupt accelerator tuning. It is used to intercept the beam so as to reduce the background radiation when beam patterns are being taken. (A.C.)

PHYSICS AND MATHEMATICS

General

1445 AECU-3849
Utah. Univ., Salt Lake City. Inst. for the Study of Rate Processes.
THE DETERMINATION OF THE POWER FACTOR OF A HIGH FREQUENCY ELECTRICAL DISCHARGE. Final Report. Jerome R. Tichy and Ransom B. Parlin. Jan. 31, 1957. 148p. Project No. 2. Contract AT(11-1)-82. (M-6144). $7.80(ph OTS); $3.30(mf OTS).

The power factor of a high frequency electrical discharge in air for a range of 3.5–4.5 mc and 0-250 mm Hg pressure has been measured. A chain mechanism has been proposed to account for the fixation of nitrogen in a high frequency discharge. A biased random walk problem of an electron travelling through a gas in an a-c field has been programmed and solved with an IBM 650 machine calculator. An interpretation of the abnormal distribution of kinetic energies obtained in the random walk problem has been given in terms of nonuniform sampling of the collision population. (auth)

1446 AECU-3859
Los Alamos Scientific Lab., N. Mex.
INSTRUMENTATION FOR LIQUID SCINTILLATION COUNTING AT LOS ALAMOS. R. D. Hiebert and F. N. Hayes. [1957]. 17p. Contract [W-7405-eng-36]. $3.30(ph OTS); $2.40(mf OTS).

Instrumentation problems involved in liquid scintillation counting are reviewed. The basic design of a coincidence system is discussed. Developments in instrumentation, operational features, performance characteristics, and ideas for future counting refinements for liquid scintillation counters are summarized. (C.H.)

1447 AECU-3868
Los Alamos Scientific Lab., N. Mex.
MEASUREMENT AND CORRECTION OF ASTIGMATIC IMAGES IN ROTATING-MIRROR SWEEPING-IMAGE CAMERAS. Berlyn Brixner. [1956?]. 11p. Contract [W-7405-eng-36]. $3.30(ph OTS); $2.40(mf OTS).

The images in rotating-mirror sweeping-image cameras are subject to serious degradation because of deformation of the mirror surface by centrifugal force. Simple optical systems for the measurement and correction of the defect are described. Included are equations for reducing the data and calculating the corrector. Samples of the data obtained and calculations for the corrector are given. (auth)

1448 AECU-3873
Massachusetts Inst. of Tech., Oak Ridge, Tenn. Engineering Practice School.
EXPERIMENTAL VERIFICATION OF SHIELDING EQUATIONS. C. L. Kusik, T. R. Jaworowski, D. C. Morse, and D. G. Strawson. Dec. 20, 1957. 26p. For Oak Ridge Gaseous Diffusion Plant. Contract [W-7405-eng-26, Subcontract 70]. (KT-323). $4.80(ph OTS); $2.70(mf OTS).

Building factors for iron shields, lead shields, and laminated iron-lead shields (1.7 mean free paths of lead and 1 to 3 mean free paths of iron per lamination) were determined for shield thicknesses up to 6.8 mean free paths of lead, 8.7 mean free paths of iron, and 9.2 mean free paths of laminated shielding. A 0.6 c Co^{60} source in the shape of a cylinder (3.4 cm in diameter and 3.4 cm high) was used. For the single component shields, the distance from source to shield was varied (from approximately zero to three shield thicknesses) and was to have only a small effect (~ 10%) on the buildup factor. The results indicated that a theoretical plane collimated buildup factor gave the best approximation to the experimental results at all source to shield distances. For the laminated shields the buildup factor was influenced mainly by the type of lamination (i.e., lead or iron) closest to the detector. With lead nearest the detector the total buildup factor was higher (20% higher at 8 free mean paths) than the buildup factor for a pure lead shield having the same number of relaxation lengths as the laminated shield. (auth)

1449 AECU-3876
Case Inst. of Tech., Cleveland.
INVESTIGATIONS ON THE THIRD LAW OF THERMODYNAMICS. Technical Report No. 2. Solomon J. Glass and Martin J. Klein. Aug. 1958. 89p. Contract AT(11-1)-623. $13.80(ph OTS); $4.80(mf OTS).

An investigation of the Third Law is of interest because it is not sufficient to satisfy the Third Law by going to low enough temperatures so that the system will be in its ground state. This involves nonthermodynamic behavior. Conditions which must be imposed on a macroscopic system so that the system will obey the Third Law are investigated. An apparent violation of the Third Law, the processes of vaporization and sublimation are considered. Two methods of obtaining the density of states from the thermodynamic functions of the system are discussed. It is found that if the density of states contains a factor which depends on an external parameter of the system, but not on the energy, the system will violate the Third Law. Also, if the density of states depends on the energy through a power law, the system violates the Third Law. Several systems are analyzed and their densities of state examined. In the processes of vaporization and sublimation the presence of the condensed phase compels the vapor to behave as a classical ideal gas. At very low temperatures, the vapor condenses before ever displaying any quantum degenerate effects. The vapor does not exist at absolute zero. The non-zero latent heats at absolute zero obtained in such experiments are due to extrapolations from a temperature at which the vapor still exists. (auth)

1450 AFOSR-TN-58-754
Utah. Univ., Salt Lake City.
PROPAGATION CHARACTERISTICS OF DETONATION GENERATED PLASMAS. L. L. Udy. June 20, 1958. 34p. Contract AF18(903)-100. (AD-201613).

Electrical conduction measurements were made in the highly ionized plasma region produced by detonating high explosives. The plasma was determined to originate directly from reaction of the high explosive rather than from thermal ionization associated with the accompanying shock wave. The mechanism of conduction was considered, and it was shown that electron flow through the plasma accounted for practically all of the current. With this in mind, it was concluded that the current flow through the plasma region was of the same nature as current flow in a metal. Conduction measurements in atmospheres of chlorine, oxygen, nitrogen, helium, and air showed that the rate of decay of the plasma was dependent upon the gaseous medium and can be explained on the basis of negative ion formation. The plasma exhibited pulsations and it was concluded that an adhesive attraction exists in the plasma through a quasi-lattice structure. Electron densities of 10^{16} electrons/cc were calculated from conduction measurements of the plasma after it had spread from the 1" diameter charge to a 2" diameter constraining tube. (auth)

1451 BNL-506
Brookhaven National Lab., Upton, N. Y.
NUCLEAR ENGINEERING DEPARTMENT PROGRESS REPORT [FOR] JANUARY 1–MARCH 31, 1958.
F. Maslan, ed. 66p. $2.00(OTS).

An improved method of drying MgCl before making up NaCl–KCl–$MgCl_2$ eutectic results in a more reproducible U partition coefficient in salt-Bi equilibration. The activity coefficient of Zr in very dilute Bi solutions was found to be 7×10^{-4} at 700°C. Annealing of irradiated quartz optical cells at 500°C is reported. The behavior of fission products I and Xe in LMFR fuel systems was studied. Corrosion tests of several materials in fused salt mixtures are reported. The operation of five in-pile loops is reviewed. Bench contactor experiments are described. Rates of transfer of Sm from Bi–Mg–Sm alloy to the ternary eutectic salt mixture were measured for the case of small drops falling through a column of salt. The pumping and corrosive effects of thorium bismuthide slurries were studied. Corrosion of steel immersed in Bi–Mg–U–Zr alloy was evaluated. A number of measurements of neutron slowing-down and diffusion parameters were made with graphite, bismuth, and graphite-bismuth mixtures. Satisfactory dissolution media were found for the Enrico Fermi Fast Breeder core. A 15-ft-long clay column experiment with a simulated waste solution spiked with 2c Sr^{90} gave a decontamination factor of 1.6×10^{8}. The mechanism of Y^{90} bonding to an anion exchange resin was determined. Reactor irradiation of LiOH produces no detectable O^{20} at currently available neutron fluxes. A satisfactory system was developed for milking As^{72} from its Se^{72} parent. A process for producing pure carrier-free Mo^{99} was developed. (For preceding period see BNL-491.) (W.D.M.)

1452 CF-56-7-46
Oak Ridge National Lab., Tenn.
UPSTREAM DIFFUSION OF RADIOACTIVE GASES.
A. H. Fox. July 14, 1956. Decl. Sept. 26, 1958. 11p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The situation of a leak of active material into a flowing air-stream presents the problem of determining possible upstream diffusion of the activity. In a constant velocity one directional flow involving three dimensional diffusion from a point source, the upstream concentration is severely limited compared to that downstream. For all practical values of the flow velocity and diffusion coefficients, this upstream concentration is negligible. It is to be noted, however, that the velocity profile of a flow in a finite channel involves points of very low velocity, and at these points the diffusion effect might predominate, resulting in some upstream diffusion. Even in this case, unknown convection effects would be more important than diffusion effects. (auth)

1453 GMR-102
General Motors Corp. Research Staff, Detroit.
AN IBM 704 PROGRAM FOR CRITICALITY SEARCH ON REACTOR PARAMETERS. J. M. Bookston and C. L. Davis. Nov. 22, 1957. 45p.

Given the material loading and geometric configuration of a nuclear reactor, GNU II, a multigroup one-dimension diffusion program for the IBM 704, will compute the effective multiplication factor. The "Criticality Search" program provides a means of automatically changing the GNU input parameters (atomic densities, dimensions or control rod position) so that the effective multiplication factor attains a specified optimum value. (auth)

1454 KAPL-M-MH-1
Knolls Atomic Power Lab., Schenectady, N. Y.
PROBLEMS IN PREDICTING FROM STRAIGHT LINE RELATIONSHIPS. Max Halperin. Aug. 11, 1958. 20p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40 (mf OTS).

In many experiments the measurements one wishes to make may be so expensive or so difficult to obtain that some alternative measurements are taken; the alternative measurement may be of the same quantity or a related quantity. On the basis of a preliminary calibration type of experiment in which both types of measurement are made, one would like to estimate the relationship between the two measurements and thus estimate the desired measurement corresponding to a subsequent alternative measurement. Assuming an underlying linear relationship between the two types of measurements, it is shown how estimation procedures and the reliability of predictions depend crucially on the assumptions made concerning errors of measurement. A review of pertinent statistical procedures and characteristics is presented, including one result which is apparently new. (auth)

1455 LA-2183
Los Alamos Scientific Lab., N. Mex.
LOW TEMPERATURE FLOW OF He^4 THROUGH NARROW CHANNELS. E. F. Hammel and A. F. Schuch. Feb. 14, 1958. 49p. Contract W-7405-eng-36. $1.50 (OTS).

The flow of He^4 through superleaks has been investigated as a function of temperature both above and below the λ-point. Conditions at the leak entrance and exit were selected from the following possibilities: immersion in the liquid, in the saturated vapor, or in the unsaturated vapor. A theory of composite flow (liquid-vapor) through the leak has been developed and compared with the experiment. Superfluid velocities have been measured for the various flow combinations, intercompared, and interpreted in terms of the well known two-fluid hydrodynamical equations. (auth)

1456 NP-7003
Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
QUARTERLY PROGRESS REPORT NO. 50. July 15, 1958. 199p. Project No. 3-99-06-108. Contract DA36-039-sc-64637.

Experiments to determine the conduction in zinc sulfide single crystals are described. The effects of a magnetic field and of a unidirectional heating current on thermionic emission from molybdenum were determined. Two subminiature tubes and a transistor were combined to make a sensitive d-c amplifier that operates from a 22.5-v dry cell battery. An experiment to study the correlation between changes in the surface-trap density and changes in the contact potential of germanium is described. The diffusion of a plasma of an infinitely long cylindrical tube in an axial magnetic field B_0 can be solved exactly in the ambipolar limit and the result will show that the plasma is diamagnetic. To measure the diamagnetism the applied magnetic field is varied and the flux change through the cylinder is observed. Since changing magnetic fields induce currents in the plasma which mask the diamagnetic effect, the limit is sought beyond which the conductivity rather than the diamagnetism of the plasma is measured. The microwave methods used to measure electron densities in a narrow plasma column placed in a cylindrical microwave cavity are summarized. The effect of electron temperature on plasma conductivity is investigated. With a low-frequency paramagnetic resonance spectrometer for observing spin transitions in the 10 to 25 mc region, single narrow lines were observed for diphenyl-trinitrophenyl-hydrazil, and potassium chomicyanide crystals. A program for studying the free angular momentum states of atoms and free radicals in a magnetic field was initiated. Antiferromagnetic resonance was observed on manganese chloride at 9000 mc. Polarization and resonances were observed in the F = $^5/_2$ and F = $^3/_2$ levels of Hg^{199}, and in the F = $^7/_2$ and $^5/_2$ levels of Hg^{201}. The hyperfine structure of radioactive Hg^{197} and Hg^{197*} was investigated. In the study of the hyperfine structure of the 2537 A Hg^{198} line, electrodless discharges in magnetic fields are used. The intensity of the emitted ultraviolet radiation which varies with the magnetic field was measured in 500 gauss steps. In microwave electronics, work is reported on mode coupling in periodic structures by variational techniques, microwave beam measurements, klystron gap theory, and the multicavity klystron. A feedforward-across-the-limiter technique was previously devised that could be arranged to suppress whichever of two co-channel FM signals is undesired. The experimental results using this technique are summarized. A study was made of FM receiver design. Dr. Norbert Wiener's lectures 3, 4, 5, and 6 on "Nonlinear Problems in Random Theory," are presented. Work on communication theory, transmission of information, network theory, speech communication, and communications biophysics is reported. (For preceding period see NP-6775.) (W.D.M.)

1457 NP-7010
Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group.
QUARTERLY PROGRESS REPORT NO. 30. Oct. 15, 1958. 73p. Contract Nonr-1841(34).

The effect of a magnetic field on the energy levels of a paramagnetic ion in an insulating crystal is considered. A method of treating Zeeman splittings is presented. Work on programming of the IBM-704 is described. Computer techniques are given. The APW method was employed to investigate the variation produced in the energy levels of potassium by modification of the assumed one-electron potential. A tabulation of the final potassium energy levels is given. Work on the energy bands in iron and Wurtzite structures is reported. Compton scattering of x rays is investigated. The spin-orbit coupling constants for the several states of N^{I}, O^{II}, and F^{III} were calculated. Electronic wave functions for polyatomic molecules were investigated. Interaction of a hole with mobile lattice ions in KCl crystals is treated. (For preceding period see NP-6840.) (W.D.M.)

1458 NP-7012
Rochester, N. Y. Univ.
SOME CONSIDERATIONS ON THE ANALYSIS OF PRIMARY COSMIC RAY INTENSITY EXPERIMENTS.
A. Engler, M. F. Kaplon, and J. Klarmann. [1958]. 34p.

A discussion is given of the procedures employed in the analysis of primary cosmic-ray intensity experiments and the assumptions inherent in their use, with particular emphasis on nuclear emulsion as a detector. Explicit formulas for extrapolation of particle intensities for various geometries employed in emulsion work are given. Some discussion of geomagnetic effects is given, and data are presented showing that the earth's shadow cone is not appreciably present at a geomagnetic latitude of 40°. (auth)

1459 NP-7016
Thompson Products, Inc., Cleveland.
THERMODYNAMIC PROPERTIES OF MERCURY.
Daniel P. Ross. Mar. 20, 1956. Revised June 17, 1957. 34p. Project No. 798. (TM-777).

The thermodynamic properties of mercury as a material which can be used as the working fluid of a Rankine cycle are tabulated. Temperature-entropy and enthalpy-temperature diagrams are given. (J.E.D.)

1460 NYO-6486 MH-VIII
New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
NONLINEAR WAVE MOTION. Magneto-Hydrodynamics Note No. VIII. K. O. Friedrichs and H. Kranzer. July 31, 1958. 61p. Contract AT(30-1)-1480. $10.80 (ph OTS); $3.90(mf OTS).

An analysis of the mathematical structure of the theory governing interaction of magnetic fields with conducting compressible fluids is presented. The basic equations governing magneto-hydrodynamics have the same mathematical character as those governing gas dynamics, and the same essential methods may be employed. A typical example is presented to demonstrate that one-dimensional magneto-hydrodynamic flow problems can be solved with the aid of shocks and simple waves as in gas dynamics. (J.R.D.)

1461 NYO-8140
Princeton Univ., N. J. Palmer Physical Lab.
POLARIZATION OF PROTONS ELASTICALLY SCATTERED FROM SEVERAL NUCLEI NEAR 17 MEV (thesis). William A. Blanpied. Oct. 1958. 189p. $24.30(ph OTS); $7.50(mf OTS).

Polarization of protons by elastic scattering from nuclei is reviewed, and the utility of polarization measurements in interpretation of scattering phenomena is considered. New angular distributions of elastic polarization were measured near 17 Mev in scattering from deuterium, Mg, Ca, Cu, Ag, and Au. Polarization appeared to be dependent on angle; often negative and positive extrema were observed within 15 degrees of each other. (auth)

1462 NYO-8673
New York Univ., New York. Atomic Energy Commission Computing and Applied Mathematics Center.
RELAXATION METHODS FOR LINEAR EQUATIONS. Samuel Schechter. Sept. 1, 1958. 46p. Contract AT (30-1)-1480. $7.80(ph OTS); $3.30(mf OTS).

Methods of group relaxation analogous to those of Gauss and Southwell are analyzed and shown to converge for symmetric positive definite matrices. The methods treated allow for a repartitioning and change in norm with each relaxation step. A method of approximate relaxation is introduced which includes over- or under-relaxation and an application is made to compound iteration processes. Explicit error estimates are given in certain cases and examples of special matrices are treated. This extends the theorems of Temple and Ostrowski to group relaxation methods and some of these are seen to be feasible for use by automatic digital computers. Relaxation processes with arbitrary orderings are shown to converge for positive definite symmetric matrices and also for a special class of matrices with non-negative inverses. (auth)

1463 ORNL-2597
Oak Ridge National Lab., Tenn.
TRANSIENT TEMPERATURES IN INFINITE PLATES, INFINITE CYLINDERS, AND SPHERES FOLLOWING A SIMULTANEOUS STEP CHANGE IN INTERNAL HEAT GENERATION RATE, COOLANT TEMPERATURE AND HEAT TRANSFER COEFFICIENT. L. G. Epel. Nov. 14, 1958. 25p. Contract W-7405-eng-26. $1.00(OTS).

1464 ORNL-2609
Oak Ridge National Lab., Tenn.
NEUTRON PHYSICS DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING SEPTEMBER 1, 1958. Oct. 28, 1958. 161p. Contract W-7405-eng-26. $3.00 (OTS).

A relatively low-power reactor research facility, the Pool Critical Assembly (PCA), was installed in one end of the pool at the Bulk Shielding Facility. A description of the facility and the initial critical experiments is given. Experiments to determine the effect on reactivity of large voids in the reflector are described. A new attempt was made to calculate the energy spectrum of the gamma rays leaking from the BSF reactor by integrating the sources over the entire reactor and applying an attenuation kernel. Some recent calculations pertaining to the UO_2-SS Bulk Shielding Reactor II are presented, as well as a status summary on the project. The latest design of the Tower Shielding Reactor II (TSR-II), with its associated controls and 5 Mw water cooling system, and several studies supporting the design are presented. The values of η of U^{233} and Pu^{239} relative to the value of η of U^{235} were determined. Experiments were performed to determine the critical parameters of aqueous solutions of 93.2% U^{235} enriched uranyl fluoride contained in cylindrical annuli formed by various combinations of aluminum cylinders varying in diameter from 2 to 30 in. Critical experiments were performed with ORR and BSR fuel elements to determine safe arrays in which the elements could be handled and stored. Experiments were performed with 2.09% U^{235}-enriched uranium metal plates in a light-water-moderated and -reflected assembly. The reflecting properties of water, Styrofoam, and Plexiglas were studied in critical experiments with 6 in. thick slabs of aqueous solutions of UO_2F_2 enriched to 93% U^{235}. A series of experiments with blocks of 2% U^{235}-enriched mixtures of UF_4 and paraffin are described. Some data are presented describing the critical conditions of spherical volumes of aqueous solutions of U^{233} and U^{235}. A study of gamma emission during thermal fission of U^{235} was carried out. The slowing down of fission neutrons in water was investigated. Results were obtained for neutron diffusion measurements for beryllium at room and liquid nitrogen temperatures. A 300-kv particle accelerator was constructed for the BSR. A detailed theoretical study was made of resonance absorption of neutrons in nuclear reactions. The connection between neutron flux and slowing down density was investigated. The empirical kernel method for treating bare critical systems is discussed and utilized to predict the material buckling of aqueous U^{235} bare reactors in an effort to clarify the age discrepancy. The infinite medium multiplication factor was computed for $U^{235}/O_2F_2-H_2O$ solutions as a function of neutron energy. The magnitude of the effect of epithermal fission for U^{235} and U^{233} aqueous homogeneous light-water-moderated reactors is estimated by use of a very simple model and values of numerical integrations of BNL-325 cross sections. The ORACLE Monte Carlo neutron age code, Chronos, was used to compute the ages of neutrons from monoenergetic sources to indium resonance, as a function of source energy, in infinite media of Be, BeO, H, O, C, C + H_2O, CH_2 (oil), $C_{12}H_{10}$ (diphenyl), D_2O, and H_2O. A Monte Carlo calculation of the gamma-ray fluxes and dose rates resulting from neutron captures in air was performed. An experiment was performed at the Tower Shielding Facility to study the production of secondary gamma-rays in air by thermal neutron capture in N and by the inelastic scattering of fast neutrons. A study of the production of secondary gamma rays in lead was made at the Lid Tank Facility with lead thicknesses that varied from 1 to 9 in. A corrected curve of thermal-neutron flux measurements in oil at the LTF is presented. Monte Carlo calculations were made for the gamma dose rate buildup and heating in stratified lead and water shields. The effect of anisotropic scattering on the neutron flux in air was investigated. A calculation was performed to determine the spectra of bremsstrahlung radiation resulting from electron degradation in sodium iodide and in air. A method for calculating the transmission of radiation through heterogeneous shields was developed, and a typical calculation for boral was performed. Neutron dose-rate distributions beyond water slabs 1, 3, 4, and 6 mfp thick were calculated for plane monodirectional, monoenergetic sources incident on the slabs at angles of 0, 30, 60, and 75°. A new gamma-ray spectrometer for use at the BSF is described. A design is presented for a pulse preamplifier suited for application with certain nuclear detectors. An investigation of the energy response of the Hornyak scintillation detector was carried out. A program for investigating the scintillation response of lithium iodide crystals to various charged particles is described. The cross section for the reaction $Li^6(n,\alpha)T$ was measured as a function of neutron energy in the region 1.2 to 8 Mev. (For preceding period see ORNL-2389.) (W.D.M.)

1465 SCTM-363-58(24)
Sandia Corp., Albuquerque, N. Mex.
SYSTEMS OF NUMERICAL NOTATION. S. S. Harris. Oct. 16, 1958. 25p. Contract AT(29-1)-789. $0.75 (OTS).

A discussion of numerical notation systems is presented for the information of persons associated with the applications of electronic computers. The exposition is designed to fulfill the needs of those who lack training in advanced mathematics but who require an understanding of numerical notation for the intelligent performance of their work. Various systems are analyzed; methods of conversion from one system to another are described; and arithmetical operations in different systems are illustrated. (auth)

1466 UCLA-392
California. Univ., Los Angeles. Atomic Energy Project.
A BATTERY OPERATED ALPHA AND BETA RADIATION RECORDER. Frank C. Strebe. Mar. 19, 1957.

16p. Contract AT-04-1-GEN-12. $3.30(ph OTS); $2.40 (mf OTS).

Design is described of a portable battery operated unit with a rate meter which can be used either with an alpha scintillation head and photomultiplier tube or with a G. M. tube. A microammeter is calibrated to read count rate. Provision is also made to read the output on an Esterline Angus recorder. Double coated transparent scotch tape is used to hold the scintillating material (silver activated zinc sulphide) on the window of the photomultiplier tube. A light trap incorporated in the unit makes it possible to place samples in the light-tight counting chamber without admitting room light to the photomultiplier tube. (auth)

1467 UCRL-3623
California. Univ., Berkeley. Radiation Lab.
SCATTERING OF ZERO-ENERGY NEUTRONS BY A SPHEROIDAL SQUARE WELL. Jack L. Uretsky. Dec. 17, 1956. 12p. Contract W-7405-eng-48. $3.30 (ph OTS); $2.40(mf OTS).

Scattering cross sections were computed for zero-energy neutrons incident upon a square well of spheroidal symmetry, depth 42 Mev, and volume equal to that of a sphere of radius $1.45 \times 10^{-13} A^{1/3}$ cm. For small distortions, the resonance that, in the spherical case, occurs near mass number 150 at first shifts slowly in the direction of higher mass numbers and then splits. When the ratio of the interfocal distance to the major axis of the spheroid is 0.4, one finds resonances at mass numbers of 135 and 160. The effect of including absorption is estimated by assuming that each resonance has the same shape as it would for a spherical well. The net effect upon the cross section is to give a very broad peaking over the rare earth region, with a maximum near mass number 170. (auth)

1468 UCRL-4844
California. Univ., Livermore. Radiation Lab.
ON THE OPERATOR APPROACH TO THE PROBLEM OF STABILITY OF DIFFERENCE SCHEMES AND THE CONVERGENCE OF CERTAIN ITERATION PROCEDURES. Arnold N. Lowan. Mar. 1957. 16p. Contract [W-7405-eng-48]. $3.30(ph OTS); $2.40(mf OTS).

A number of considerations related to the stability of certain difference analogs of the differential equation of heat conduction and with the convergence of iteration procedures derived from implicit difference equations are presented. The operator approach is used in a manner which dispenses with the knowledge of eigenvalues. (J.R.D.)

1469 UCRL-5038(Rev.)
California. Univ., Livermore. Radiation Lab.
THE PROMPT RADIATIONS IN THE SPONTANEOUS FISSION OF Cf^{252}. H. R. Bowman and S. G. Thompson. July 25, 1958. 12p. Contract W-7405-eng-48. $3.30 (ph OTS); $2.40(mf OTS).

This is a revision of A/CONF.15/P/652.

The availability of comparatively large sources of the isotope Cf^{252} has made it possible to undertake a program of measurements of the prompt radiations emitted in the spontaneous fission of this isotope. Cf^{252} has a spontaneous-fission half life of seventy years, and sources emitting neutrons at the rate of $\sim 10^7$ neutrons per minute have been used in the work to be described. The experiments were performed to obtain information which would lead to a better understanding of the fission process and fission energetics. The energy released in fission is distributed in fission-fragment kinetic energies, gamma radiations, and prompt neutron emission. An attempt to make simultaneous measurements of as many as possible of the energies, multiplicities, and angular distributions of the radiations in single-fission events was made. (auth)

1470 UCRL-5242
California. Univ., Livermore. Radiation Lab.
THE THEMIS CODE: AN ASTRONOMICAL NUMERICAL INTEGRATION PROGRAM FOR THE IBM 704. Edna Vienop and Joseph L. Brady. May 20, 1958. 33p. Contract W-7405-eng-48. $1.00(OTS).

The Themis program is designed as a general astronomical numerical integration routine and is suitable for integrating the motion of satellites, coments, and planets. The equation of motion may include the effects of a model atmosphere and also the effects of an equatorial bulge that has been adjusted to represent the Earth as well as available satellite observations allow. (auth)

1471 USNRDL-TR-255
Naval Radiological Defense Lab., San Francisco.
A LOW RANGE BETA-GAMMA SURVEY METER. M. H. Eklund and G. A. Work. Feb. 3, 1958. 56p.

A low range beta-gamma survey meter employing halogen-quenched G-M tubes and transistor circuitry has been developed. The instrument measures gamma radiation from 0 to 500 mr/hr in four linear ranges and provides beta indication on all ranges. The instrument has been conservatively designed to meet military specifications. A transistor oscillator converts battery voltage to regulated high and low voltages, giving more than 400 hours of operation with two easily obtainable flashlight cells. The use of a corona regulator has been avoided. The rate-meter is an advanced zero-stable diode pump circuit requiring no pulse-width range switching. The survey meter has been packaged in a form providing easy handling with one-hand operation for some monitoring applications. The instrument is also alpha sensitive, reading an equivalent 2 mr/hr in contact with a plutonium source of 5.10^{-3} microcuries/cm^2. (auth)

1472 AEC-tr-3440
REFINEMENT OF COMPUTING METHODS FOR THE PRECISION DETERMINATION OF LATTICE CONSTANTS OF CUBIC CRYSTALS BY THE POWDER METHOD. Hermann Weyerer. Translated for Los Alamos Scientific Lab. from Z. Krist. 109, 338-53 (1957). 11p.

A method is given for the accurate evaluation of powder photographs of cubic substances based upon the Gauss correlation theorem. The advantages of this method as compared to the one by Cohen are described. Equally good results can be obtained by means of improved graphical extrapolation methods which are even more convenient to handle. The accuracy of the various methods is discussed using a precise x-ray powder photograph of gold as an example. (auth)

1473 AEC-tr-3457
USE OF REMOVABLE PLASTIC-BASE VARNISH FOR PROTECTION AGAINST RADIOACTIVE CONTAMINATION. H. Dreibeller and E. H. Graul. Translated by Lydia Venters (Argonne National Lab.) from Atompraxis 4, 177-8(1958). 7p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 11261.

1474 NP-tr-162

WAVELENGTHS AND TERM SYSTEMS OF THE ATOMIC SPECTRA OF THE ELEMENTS LITHIUM, BERYLLIUM, BORON, CARBON, NITROGEN AND OXYGEN. Bengt Edlén. Translated by N. Willis (U.K.A.E.A., Atomic Energy Research Establishment) from Nova Acta Regiae Soc. Sci. Upsaliensis [4] 9, No. 6, (1934). 60p.

A short review is presented of efforts to lower the spectra wavelength detection limit starting with Millikan's work, pointing out that the reason for recent progress in the extreme ultraviolet is the increase in reflecting power of a grating at grazing incidence. The operation and design of the experimental equipment are described, including the grating, the spectrograph, and the light source. The method of wavelength determination is given, along with a discussion of the vacuum spark spectra of C, N, and O. A theoretical form for the description of atomic spectra, which allows a convenient summary of the experimental data of very complicated spectra, was obtained. The results of the theory are given, including the electronic configuration and corresponding energy states (terms) characterized by quantum numbers. Combination rules in identification of experimentally found energy levels are also given. The dependence of the components of a multiplet on the J-values is pointed out, and an explanation of the absolute values of the terms is given. Finally, descriptions and tabulations of spectra in quanta groupings with the element whose spectra they resemble are given. These groupings include those resembling H, He, Li, Be, B, C, and N. (J.R.D.)

1475 NP-tr-188

PHASE CORRELATION PROPERTIES OF SIGNALS AND GAUSSIAN NOISE IN TWO-CHANNEL PHASE SYSTEMS. V. V. Tsvetnov. Translated by Leon Zelby (Lincoln Lab., MIT) from Radiotekhnika 13, No. 4, 53-62(1958). 19p.

Correlation properties of phase differences in two-channel phase systems due to gaussian noise were investigated, yielding analytical relations for the correlation functions of phase differences for the case of pure noise and for the case of strong signals. The correlation properties of phase differences are compared with the correlation properties of the gaussian noise envelope. (auth)

1476 SCL-T-47

NEWER INVESTIGATIONS ON TRIBOLUMINESCENCE. (Neuere Untersuchungen über dis Tribolumineszenz). G. Wolff, G. Gross, and I. N. Stranski. Translated by M. I. Weinreich (Sandia Corp.) from Z. Elektrochem. 56, 420-8(1952). 31p.

Triboluminescence may be expected in substances whose areas of fracture display electrical differences of potential with respect to each other. A permanent triboluminescence capacity is hence a structural property, whereas the occurrence of temporary triboluminescence seems to be linked to other requisites, such as disturbances and transformations of the lattices. These assumptions are tested and found to be plausible for a large number of substances. More than five hundred triboluminescent substances are listed. (A.C.)

1477 SCL-T-200

THE BALL LIGHTNING. A BIBLIOGRAPHY. (Der Kugelblitz. Eine Bibliographie). R. Aniol. Translated by Marcel I. Weinreich (Sandia Corp.) from Meteorol. Rundschau 7, Nos. 11/12, 220-2(1954). 8p.

A survey of all available ball lightning observations from 1923 to 1954 is presented. A list of reports pertaining to the ball lightning, containing 70 bibliographical references, is kept in the German Weather Service. (J.R.D.)

1478 SCL-T-205

TENTATIVE INTERPRETATION OF THE AIR MOVEMENT OVER CENTRAL EUROPE. (Versuch einer Deutung der Luftbewegung über Mitteleuropa). Oskar Essenwanger and Rupert Holzapfel. Translated by Marcel I. Weinreich (Sandia Corp.) from Meteorol. Rundschau 10, 119-24(1957). 15p.

The observed frequency distributions of the wind direction up to 16 km altitude over Berlin and Munich are considered formally as sums of the Gaussian normal curves. For the presentation of the observed wind roses at all altitudes and in any of the four seasons, it suffices to use, as a rule, 4 partial collectives which have their point of gravity approximately in the cardinal point directions. Presumably, those 4 main wind systems originate by means of 4 circulation bodies. (auth)

1479 TT-743

THE DETECTION OF RADICALS BY THE NUCLEAR RESONANCE METHOD. (Indikateiia radikalov iaderno resonansnym metodom). L. L. Dekabrun and A. P. Purmal'. Translated by D. A. Sinclair (National Research Council of Canada) from Doklady Akad. Nauk S.S.S.R. 116, 983-5(1957). 6p.

The thermal decomposition of H_2O_2 was investigated by the nuclear resonance method. Neither water nor 30% H_2O_2 gave a proton absorption at room temperature. When the temperature was increased, the H_2O_2 decomposition rate was increased, and an increase in the proton absorption signal was observed. It was observed that there is a strong decrease in relaxation time in certain solid samples exposed to high-energy radiation and that radicals influence the relaxation time. Thus the radicals may be detected by nuclear magnetic resonance. (J.R.D.)

1480

THE MONOCLINIC MODIFICATION OF GADOLINIUM SESQUIOXIDE Gd_2O_3. O. J. Guentert and R. L. Mozzi (Raytheon Mfg. Co., Waltham, Mass.). Acta Cryst. 11, 746(1958) Oct.

The x-ray-diffraction patterns were run at room temperature on a Norelco diffractometer. The patterns suggest that Gd_2O_3 form B is isomorphous with the monoclinic Sm_2O_3 form B. The observed powder lines and their relative peak intensities are tabulated. (auth)

1481

THE CRYSTAL STRUCTURE OF UN BY NEUTRON DIFFRACTION. Melvin H. Mueller and Harold W. Knott (Argonne National Lab., Lemont, Ill.). Acta Cryst. 11, 751-2(1958) Oct.

1482

LOW LEVEL PLUTONIUM-241 ANALYSIS BY LIQUID SCINTILLATION TECHNIQUES. Donald L. Horrocks and Martin H. Studier (Argonne National Lab., Lemont, Ill.). Anal. Chem. 30, 1747-50(1958) Nov.

The plutonium-241 content of plutonium samples can be determined with a high degree of confidence with the liquid scintillation spectrometer. The plutonium-241 β particles are counted with a relatively high and easily reproduced efficiency of 37%. The very low limit of detection, 10^{-15} gram of plutonium-241, and the ease of recovery of the plutonium for further investigations give this method added advantages over other methods of analysis. (auth)

1483

NUCLEAR EMULSION TECHNIQUE FOR DETERMINATION OF THE PLUTONIUM-240—PLUTONIUM-239 RATIO. Eric N. Sloth and Martin H. Studier (Argonne National Lab., Lemont, Ill.). Anal. Chem. 30, 1751-3 (1958) Nov.

The plutonium-240—plutonium-239 ratio has been determined in submicrogram quantities of plutonium by using a nuclear emulsion technique. The method is based on the fact that 11% of the plutonium-239 α particles have coincident electrons arising from the conversion of gamma rays, while 24% of the α particles from plutonium-240 have coincident conversion electrons. The fraction of alpha tracks with associated conversion electron tracks is determined by scanning the photographic plate with a microscope. The accuracy of the method is limited by the statistics involved in the track counting, but the plutonium-240—plutonium-239 ratio can be determined at the level of 10^{-11} gram of plutonium. (auth)

1484

LOW-ENERGY STANDARDS FOR GAMMA-RAY SPECTROMETRY. George M. Matlack, Jesse W. T. Meadows, and Gilbert B. Nelson (Los Alamos Scientific Lab., New Mex.). Anal. Chem. 30, 1753-8(1958) Nov.

A simple type of low-energy calibration standard for γ-ray spectrometry has been developed for the range 5 to 75 kev. Standards are made by placing a target of a single element over a pure beta emitter, such as promethium-147 or strontium-90. Characteristic x rays of the target element are generated, usually the Kα radiation, although L x rays are predominant for very thin targets. For energy calibrations greater than 17 to 20 kev it is best to use thin metallic foil targets or pressed oxide disks. Standards for energies less than 17 kev are best prepared by mixing a solution of the beta emitter with a few milligrams of a salt of the target element, and evaporating to dryness on a micro cover glass. By this technique, the lowest energy Kα x ray clearly observed was that of vanadium at 4.96 kev, using a $1\frac{1}{2} \times \frac{1}{2}$ inch thallium-activated sodium iodide crystal equipped with a 0.005-inch beryllium window. The use of these standards affords a simple and convenient technique for checking nonlinear response in the low-energy region for scintillation detector systems, measuring the noise level of multiplier phototubes, and identifying radioactive elements which emit converted γ rays. (auth)

1485

DEVELOPMENT AND PREPARATION OF A SET OF GAMMA SPECTROMETER STANDARDS. L. J. Beaufait, Jr., E. E. Anderson, and J. Paul Peterson (Tracerlab, Inc., Richmond, Calif.). Anal. Chem. 30, 1762-4(1958) Nov.

Remarkably few gamma emitters have decay schemes sufficiently well established to make good standards for accurate efficiency calibration. The absolute gamma-emission rate for any isotope is not generally known better than ±5% probable error. From the extensive list of available gamma emitters, eight isotopes were selected on the basis of their established decay scheme, availability, half life, and convenience of radiation characteristics: cadmium-109, barium-133, tin-113, cesium-137, sodium-22, manganese-54, zinc-65, and cobalt-60. The method of calibrating each of these isotopes and the resulting data obtained on standard [NaI(Tl)] crystal scintillation counter setup are described. (auth)

1486

STUDY OF NEUTRON ABSORPTIOMETRY AND ITS APPLICATION TO THE DETERMINATION OF BORON. Donald D. DeFord and Robert S. Braman (Northwestern Univ., Evanston, Ill.). Anal. Chem. 30, 1765-72(1958) Nov.

A systematic study of the practical and theoretical aspects of neutron absorptiometry has shown that it possesses many advantages for the determination of elements, such as boron, which have high neutron absorption cross sections. The optimum geometrical arrangement of neutron source, neutron moderator, sample, and neutron detector has been found. Precise determinations of boron can be carried out in a few minutes with relatively small, safe, and inexpensive neutron sources. The method is nondestructive, the state of chemical combination is immaterial, and there are few interferences. The most serious disadvantages are low sensitivity and the requirement for relatively large samples for highest precision. (auth)

1487

SMALL-ANGLE SCATTERING OF X-RAYS. Göran Wassberg and Kai Siegbahn. Arkiv Fysik 14, 1-15(1958).

Various types of equipment for small angle scattering of x rays are discussed. The experiments made to reduce the long exposure time by bending crystals spherically so that they are double-focussing are described. Two different methods of bending crystals were employed. The circular quartz crystals were bent between two circular edges or fixed to a spherically polished crystal holder by a vacuum between the crystal and the holder. A short summary of the basic theory is given. The investigation of polystyrene latex by small-angle x-ray scattering is described. (W.D.M.)

1488

ON THE ADAPTATION OF AN INTERMEDIATE-IMAGE OF β-SPECTROMETER TO PAIR SPECTROSCOPY. J. Kjellman and B. Johansson (Nobel Inst. of Physics, Stockholm). Arkiv Fysik 14, 17-29(1958).

An iron-jacketed intermediate-image β-spectrometer was adapted for high energy γ-ray measurement from cyclotron-induced reactions. The technique used in the so-called statistical-separation pair detection technique. The apparatus was tested and calibrated with help of the 6.065 ± 0.009 Mev pair emitting state in O^{16}. A method of using the spectrometer for measuring short half lives of excited states is described. The natural phase-bunching of the cyclotron is then used as an indicator of the time when a state is born. (auth)

1489

ON THE RATE OF CONVERGENCE OF THE SPHERICAL-HARMONICS METHOD IN THE MILNE PROBLEM. B. Davison (Univ. of Toronto). Can. J. Phys. 36, 1323-35(1958) Oct.

The extrapolated end point, z_0, and the ratio of current to flux at the free surface, $j(0)/\rho(0)$ for the Milne problem are evaluated by the spherical-harmonics method in the P_N approximation, N being odd. It is shown that, for N large, the approximations to these quantities are related to the exact values by (A) $z_{0,N} = z_0 - \pi^2 c/48N^2 + O\{(c^2+1)/N^3\} + O[N(\zeta_1/\zeta_2)^N f_1(c)]$, (B) $[\psi_1(0)/\psi_0(0)]_N =$

$[j(0)/\rho(0)]\{1 + O[(\zeta_1/\zeta_2)^N f_3(c)]\}$, in which c is the number of secondaries per collision, $f_1(c)$ and $f_3(c)$ are independent of N, and ζ_1 and ζ_2 are the absolutely lesser and greater roots of $\zeta^2 - 2\zeta + \kappa^2 = 0$, κ being the exact inverse diffusion length. The relation (A) is subject to the restrictions, $N \gg c$ if $c > 1$, $N(|\zeta_1/\zeta_2|)^N \ll 1$ if $c < 1$. (auth)

1490

CHARACTERISTIC MULTIPLETS OF THE X EMISSION SPECTRUM OF ERBIUM. Paul Sakellaridis. Compt. rend. 247, 921-3(1958) Sept. 29. (In French)

The existence of the incomplete internal 4f shell in the rare earths gives rise to a reduction of certain, usually narrow, dipolar emissions. The results concerning multiplets of the L spectrum are given. (tr-auth)

1491

A THEORETICAL STUDY OF THE HYDRAULIC CYCLONE. D. Bradley (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Ind. Chemist. 34, 473-80(1958) Sept.

The pressure drop and efficiency of a hydraulic cyclone are considered theoretically, leading to equations which predict the performance of a particular cyclone design. The equations may be used in the design of a hydraulic cyclone with sharp separation at minimum particle size. (J.R.D.)

1492

THEORY OF RADIOISOTOPE SCANNING. G. L. Brownell (Massachusetts General Hospital, Boston). Intern. J. Appl. Radiation and Isotopes 3, 181-92(1958) Aug.

The visualization of radioisotope distributions is an increasingly important application of radioisotopes. A general relation is derived, valid for any detecting system, yielding the optimal radioisotope content as a function of resolution, detector efficiency, time duration of scan, and dimensions of the object being scanned. Various collimating systems are considered and isoefficiency curves calculated. The simplest collimator consists of a cylindrical aperture in a lead shield. The use of a tapered aperture improves the sensitivity somewhat for a given resolution. A focusing detector may be constructed by means of a series of tapered apertures aimed at a focal spot. Finally, the detection of annihilation radiation resulting from positron detection is considered. The resolution and efficiency of these collimating systems are compared. Numerous factors modify the general considerations. The effect of penetration of lead by the γ-rays is considered as well as the effect of finite source sizes and the attenuation of radiation in the object being scanned. Background radiation arises from many sources and results in an effective limit to the amount of radioisotope which can be employed. Examples of single-channel and coincidence scanning techniques are given. (auth)

1493

TECHNIQUES FOR THE VISUALIZATION OF INTERNAL ORGANS BY AN AUTOMATIC RADIOISOTOPE SCANNING SYSTEM. W. J. MacIntyre, A. M. Rejali, J. H. Christie, F. S. Gott, and T. S. Houser (Western Reserve Univ., Cleveland). Intern. J. Appl. Radiation and Isotopes 3, 193-206(1958) Aug.

In the application of an automatic radioisotope scanning system to the visualization or delineation of large organs, emphasis has been placed on techniques applicable to the detection of a slight decrease of radioactivity in the presence of a highly radioactive surrounding, and the detection of a high concentration of radioactivity in the presence of an environment only slightly less radioactive. The general features of this method have been discussed together with a detailed account of increasing these small differentials by both a counting rate controlled contrast circuit and an accentuated technique of light recording. Clinical examples of the visualization of the thyroid, liver, and heart with these techniques are presented. (auth)

1494

SOLID SOURCES FOR MEASURING THE RADIOACTIVITY OF S^{35}. A. Rezanowich (Pulp and Paper Research Inst. of Canada, Montreal). Intern. J. Appl. Radiation and Isotopes 3, 251-2(1958) Aug.

A procedure is described for the accurate and reproducible counting of sources containing sulfur-35. It is suggested that the procedure may be applied to other soft beta emitters as well. (C.H.)

1495

THE PHOSPHATES OF THE RARE EARTHS WITH ZIRCON STRUCTURE. A. Durif (Inst. Fourier, Grenoble, France). J. phys. radium 19, 55S(1958) Aug.-Sept. (In French)

Phosphates of Gd, Dy, Er, and Yb were prepared, and the Debye-Scherrer diagrams showed that the phosphates of Dy, Er, and Yb crystallized into a zircon-type structure. The crystallographic characteristics are given. It is suggested that all the rare earths with an ionic radius less than that of Dy would have phosphates with the same structure. (J.S.R.)

1496

CUT-OFF OF THE MAGNETIC MOMENT OF PRASEODYMIUM IN PRASEODYMIUM GALLATE. Y. Ayant. J. phys. radium 19, 58S(1958) Aug.-Sept. (In French)

The curve of magnetic susceptibility of praseodymium gallate shows the existence of a Curie-Weiss law with an effective moment of 3.6 bm at high temperatures and at low temperatures the existence of a Curie-Weiss law with an effective moment of 2.9 bm. The theoretical value of 2.83 bm was found for the effective moment at low temperatures. (J.S.R.)

1497

OBSERVATION OF HIGH INTENSITY RADIATION BY SATELLITES 1958 ALPHA AND GAMMA. J. A. Van Allen, G. H. Ludwig, E. C. Ray, and C. E. McIlwain (State Univ. of Iowa, Iowa City). Jet Propulsion 28, 588-92(1958) Sept.

A preliminary report of results obtained concerning radiation intensities measured with single Geiger tubes carried by Explorer I and III is presented. Resonable cosmic-ray counting rates were obtained for altitudes below about 1000 km. A plot of omnidirectional intensity vs. height in the vicinity of California for the first two weeks in February was obtained. This curve, extrapolated down to altitudes previously reached by rockets, agrees with earlier data. At altitudes greater than about 1100 km, very high counting rates were obtained. (W.D.M.)

1498

OUTGASSING OF VACUUM MATERIALS AT ROOM TEMPERATURE. R. Barré, R. Geller, and G. Mongodin (Centre d'Etudes Nucleaires Saclay, France). Le vide No. 69, 195-201(1958) May-June. (In French)

Experimental data are presented on the outgassing of various rubbers, steels, and Araldite. A comparison is given of the degasification. The results obtained for the rubber are rigorous only for the samples tested. From one variety of Perbunan to another a variation by a factor of two is possible. However, the results obtained for the steel are comparable to other steels. (J.S.R.)

1499

CONTRIBUTION OF HIGH-ENERGY PARTICLES TO THERMONUCLEAR REACTION RATES. G. Eder (Univ. of Vienna) and H. Motz (Univ. of Oxford). Nature 182, 1140-2(1958) Oct. 25.

The possibility of using acceleration processes within a gas discharge for the purpose of production of fusion power is discussed. Data obtained by means of ZETA are reviewed. Reaction rates due to particles belonging to the tail of the Maxwell distribution are analyzed. An approximation to the reaction rate is obtained by means of a method due to Gamow. It is observed that ions with fairly low energies in the laboratory system have on average a high relative energy. This may be relevant when one is considering the effect on the reaction rate of accelerated deuterons inserted into a discharge. In the case of the D-T reaction the effective percentages are shown to be rather low, indicating that relatively few accelerated deuterons injected into a plasma may produce reaction rates comparable to the purely thermonuclear ones. (C.H.)

1500

THE METHOD OF DISCRETE ORDINATES. Gerald Goertzel (Nuclear Development Corp. of America, White Plains, N. Y.). Nuclear Sci. and Eng. 4, 581-7 (1958) Oct.

The solution of the neutron transport (Boltzmann) equation in plane and spherical geometries is considered. It is demonstrated that the method of discrete ordinates differs from the spherical harmonic method merely by a linear transformation (with constant coefficients) of the dependent variables. (auth)

1501

PERTURBATION INTEGRALS FOR TWO GROUP CALCULATIONS AND APPLICATION TO REFLECTOR DUCTS. Gene A. Baraff, Raymond L. Murray, and A. C. Menius, Jr. (North Carolina State Coll., Raleigh). Nuclear Sci. and Eng. 4, 623-34(1958) Nov.

Two group perturbation theory of thermal reactors is reviewed and tables of fluxes, adjoint fluxes, arbitrary coefficients, and computation constants are given. A general reactivity formula in matrix notation is derived, and integrals needed in the evaluation of perturbations in the core and reflector are tabulated. The special problem of a reflector void of constant cross-sectional area is also considered. (auth)

1502

SHIELDING-GLASS BUILDUP FACTORS. John W. Lindner (Pittsburgh Plate Glass Co.). Nucleonics 16, No. 10, 77(1958) Oct.

Gamma-ray buildup factors for three shielding glasses are presented. The computations were based on standard methods. (J.S.R.)

1503

DESIGNING FOR BLAST PROTECTION. F. B. Porzel (Armour Research Foundation, Chicago). Nucleonics 16, No. 10, 82-5(1958) Oct.

Designing for blast protection in a reactor is largely a matter of understanding the properties of the strong shock waves that would emanate from hypothetical nuclear explosions. The typical characteristics of a shock wave formed by the abrupt release of energy are given. Blast shields and channeling are shown to be two efficient methods of blast protection. Reflecting barriers, isolation air gaps, and energy-release duration are methods which are inadequate. (J.S.R.)

1504

PERMISSIBLE WEIGHT CONCENTRATIONS FOR ENRICHED URANIUM. Charles A. Pelletier (Astra, Inc., Milford, Conn.). Nucleonics 16, No. 10, 111(1958) Oct.

The maximum permissible weight concentration, which is the ratio of the maximum permissible concentration to the specific activity, is plotted as a function of U^{235} enrichment. There is a rapid decrease in allowable weight concentration as enrichment increases from natural to 5%. (J.S.R.)

1505

STRUCTURE OF A SHOCK WAVE IN FULLY IONIZED HYDROGEN. D. A. Tidman (Univ. of Chicago). Phys. Rev. 111, 1439-46(1958) Sept. 15.

The Fokker-Planck equations are used to examine the structure of a shock wave in fully ionized hydrogen. This is done by assuming a bimodal Maxwellian distribution for the protons in the interior of the shock and noting that the electrons are in thermal equilibrium with themselves but not necessarily with the protons. The method is essentially an extension of that used by Mott-Smith in his analysis of the Boltzmann equation for a shock wave in a gas of neutral atoms. (auth)

1506

LENGTH EFFECT IN THE HEAT TRANSPORT IN HELIUM II. H. Forstat (Michigan State Univ., East Lansing). Phys. Rev. 111, 1450-2(1958) Sept. 15.

A length effect in heat transport in helium II in small channels was observed. Measurements were made using a column of packed jeweller's rouge for lengths of 3.179, 5.166, and 8.156 cm in the temperature range 1.70 to 2.17°K. The channel size was approximately 0.1 micron. The results verified the linear dependence of the heat current density on temperature difference and showed a decrease in the heat transport by approximately a factor of 2 as the rouge length was increased from 3.179 to 8.156 cm. (auth)

1507

VARIATIONAL APPROACH TO THE MANY-BODY PROBLEM. R. U. Ayres (Univ. of London). Phys. Rev. 111, 1453-60(1958) Sept. 15.

Certain problems connected with the choice of trial variational functions for the quantum many-body problem are discussed. It is convenient to make use of the reduced-density-matrix formulation developed by Löwdin and Mayer, since a system whose Hamiltonian contains only 1- and 2-body interactions is characterized by the two simplest reduced density matrices $\Gamma^{(1)}$ and $\Gamma^{(2)}$. It is known that symmetry, Hermiticity, and normalizability conditions are not sufficient to ensure a physically realizable choice of the functions $\Gamma^{(1)}$ and $\Gamma^{(2)}$. However an additional nontrivial restriction is imposed by the fact that such functions must be possible variational extrema. The implications of this condition are investigated in some detail and it turns out that all the nonphysical choices of $\Gamma^{(1)}$ and $\Gamma^{(2)}$ which have been exhibited by various authors are eliminated. The condition is essentially nonquantum inasmuch as an analogous argument should be possible for a classical system.

Moreover one of the consequences of this condition is that the system (classical or quantum) may exhibit macroscopic behavior, i.e., order-disorder transitions. The analysis leads to apparently reasonable choices of trial forms for $\Gamma^{(1)}$and $\Gamma^{(2)}$, although it is still not known whether any further restriction must be imposed to complete the sufficiency argument. (auth)

1508

MEISSNER EFFECT. Gregor Wentzel (Univ. of Chicago). Phys. Rev. 111, 1488-92(1958) Sept. 15.

The magnetic properties of the Bardeen-Cooper-Schrieffer model of a superconductor are investigated by means of Bogoliubov's mathematical method. A derivation of the Meissner effect is given which is strictly gauge invariant in every step. (auth)

1509

PROPAGATION OF A MAGNETIC FIELD INTO A SUPERCONDUCTOR. Joseph B. Keller (New York Univ.). Phys. Rev. 111, 1497-9(1958) Sept. 15.

The propagation of a magnetic field into a superconducting wire of circular cross section is analyzed theoretically. Upper and lower bounds are obtained on t_0, the time required for the field to reach the axis, and on R(t), the inner radius of the normally conducting region. The lower bound is just the approximate result obtained by Sixtus and Tonks, Pippard, and Lipshitz. It was verified experimentally by Faber for applied fields less than 1.04 times the critical field. It is believed that for large applied fields the actual results should be closer to the upper bounds. (auth)

1510

MEASUREMENTS OF LIGHT MASSES WITH THE MASS SYNCHROMETER. Lincoln G. Smith (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 111, 1606-19 (1958) Sept. 15.

A complete account is presented of all results obtained with the mass synchrometer before November, 1957. Included, besides measurements made before March, 1957, tentative values of most of which have been published with little discussion by the author and/or by others, is an extensive later set of measurements on 40 parent ion doublets. From least squares analyses of 39 of these doublet values and of 11 selected earlier values and from three other earlier values are derived what are believed to be the best values obtainable from all synchrometer data of the mass excesses of the 14 nuclides from which all ions studied are composed. These are H^1, D^2, He^4, B^{10}, B^{11}, C^{12}, N^{14}, O^{16}, Ne^{20}, Ne^{22}, S^{32}, Cl^{35}, Cl^{37}, and Ar^{40}. Best values of all measured doublets are also tabulated. Statistical analyses indicate that, for external consistency of results, the internal errors given should be multiplied by either 2.35 or 3.6 (the larger fraction applying primarily in cases where ions are formed by molecular dissociation). They also indicate that, except in cases where ions are formed with appreciable kinetic energies, the external error of the mean of twenty measurements of a doublet separation made with present techniques is about one part in 4×10^7 of the mass number. The agreement of the best values with the latest comparable values obtained at the University of Minnesota is excellent for the important mass excess C−12 and satisfactory in nearly all other cases. Agreement with comparable values obtained from measurements of nuclear reaction energies is fairly good except for C_3-HCl^{35} and $Cl^{35}-35$, the synchrometer values of which appear to be in error. (auth)

1511

ANALYSIS OF GAMMA-GAMMA ANGULAR CORRELATIONS INVOLVING MULTIPOLE MIXTURES. R. G. Arns and M. L. Wiedenbeck (Univ. of Michigan, Ann Arbor). Phys. Rev. 111, 1631-3(1958) Sept. 15.

A method is outlined which provides for rapid analysis of directional correlations involving gamma rays of mixed multipolarity. Specific examples are given to illustrate the application to cascades in which one or both transitions involve a mixture of dipole and quadrupole radiation. (auth)

1512

DIRAC-LIKE WAVE EQUATIONS FOR PARTICLES OF ZERO REST MASS, AND THEIR QUANTIZATION. J. S. Lomont (IBM Research Center, Ossining, N. Y.). Phys. Rev. 111, 1710-16(1958) Sept. 15.

The basic algebraic structure of the Maxwell equations (in a particular form) is first abstracted. This structure is then used as a model for wave equations for other massless particles. Gauge-independent wave equations of Dirac type (more precisely, of Pauli type) are thus found for every half-integral positive spin. Multiple-spin equations of Dirac types are also found. The single-spin equations are then quantized. The infinite-dimensional equations are not considered. (auth)

1513

CHANGES IN THE 1955 ATOMIC CONSTANTS OCCASIONED BY REVISION OF μ_e/μ_0. E. Richard Cohen (Atomics International, Canoga Park, Calif.) and Jesse W. M. DuMond (California Inst. of Tech., Pasadena). Phys. Rev. Letters 1, 291-2(1958) Oct. 15.

The value of the "anomaly" ratio μ_e/μ_0 has been changed due to a change in the numerical coefficient of the quantum electrodynamic correction term to 0.328. The corrected formula now reads $\mu_e/\mu_0 = (1 + \alpha/2\pi - 0.328\,\alpha^2/\pi^2) = 1.0011596130$, which corresponds to a change of 14.3 ppm in the old value of the ratio. Changes to be expected in seven important output values for a change of 14.3 ppm in μ_e/μ_0 are given. (W.D.M.)

1514

OPTICAL DETECTION OF NARROW Rb^{87} HYPERFINE ABSORPTION LINES. P. L. Bender and E. C. Beaty (National Bureau of Standards, Washington) and A. R. Chi (U. S. Naval Research Lab., Washington). Phys. Rev. Letters 1, 311-13(1958) Nov. 1.

Optical detection of the ground state hyperfine transition has been reported for sodium vapor and for cesium vapor. The collisional narrowing technique suggested by Dicke was used to reduce the Doppler width. Results are reported for Rb^{87} vapor using a different optical pumping method. Absorption lines narrower, by a factor 300, than the normal Doppler width were achieved. The experimental arrangement is described. (W.D.M.)

1515

COEFFICIENT OF THERMAL EXPANSION OF LIQUID He^3 NEAR 0°K. K. A. Brueckner and K. R. Atkins (Univ. of Pennsylvania, Philadelphia). Phys. Rev. Letters 1, 315-16(1958) Nov. 1.

Recent calculations on the properties of liquid He^3 near 0°K have determined the specific heat and its variation with density. The relationship between this result and the coefficient of thermal expansion is investigated. (W.D.M.)

1516

ALIGNMENT OF METASTABLE HELIUM ATOMS BY UNPOLARIZED RESONANCE RADIATION. P. A.

Franken and F. D. Colegrove (Univ. of Michigan, Ann Arbor). Phys. Rev. Letters 1, 316-18(1958) Nov. 1.

Experiments in which helium atoms in the $^3S_1$ metastable state were aligned by the action of unpolarized optical resonance radiation are reported. The alignment was detected by resonance methods; the observed line widths are of the order of a milligauss with a raw signal-to-noise ratio of ~100:1. The simplest experimental arrangement is described and the theory outlined. (W.D.M.)

1517

CONDUCTION ELECTRON-MAGNETIC ION INTERACTION IN RARE EARTHS. Gerald S. Anderson and Sam Legvold (Iowa State Coll., Ames). Phys. Rev. Letters 1, 322-4(1958) Nov. 1.

The proposal is made that there is an additional effective electron-electron interaction in the rare earths which results from the conduction electron-magnetic ion exchange. The strength of the net electron-electron interaction should then be expected to be a function of spin as well as solute concentrations. (W.D.M.)

1518

IONIZING RADIATION ASSOCIATED WITH SOLAR RADIO NOISE STORM. K. A. Anderson (State Univ. of Iowa City). Phys. Rev. Letters 1, 335-7(1958) Nov. 1.

Beginning at 1525 U.T. on August 22, 1958, ionizing radiation appeared at an atmospheric depth of 10 g/cm^2 in time association with a great solar radio noise storm. The response of three balloon-borne detectors, single counter, counter telescope, and ion chamber, is shown. The rates of the ion chamber and counter telescope rose by as much as a factor of ten above the cosmic-ray level while the single counter increased by a much smaller factor. The relative responses of the three detectors are given, and it is deduced that these ratios are wholly consistent with protons having an energy loss no greater than 4.5 times minimum ionization as was determined by comparing their ion chamber to single counter ratio with that for cosmic rays and using data on average specific ionization. (W.D.M.)

1519

MAGNETIC ABSORPTION IN THE SPIN SYSTEM OF SOME PARAMAGNETIC SALTS AT ABOUT 1325 MHz. H. Hadders, P. R. Locher, and C. J. Gorter (Kamerlingh Onnes Laboratorium, Leiden, Netherlands). Physica 24, 839-47(1958) Oct.

An apparatus has been constructed for the measurement of paramagnetic losses and paramagnetic susceptibilities at a frequency of 1325 MHz. The properties of this set up are discussed, particularly a method is given by which the measured χ'' can be related to the static susceptibility χ_0. Results have been presented on the losses of powdered $CrK(SO_4)_2.12H_2O$, $FeNH_4(SO_4)_2.12H_2O$, $Mn(NH_4)_2.6H_2O$ and $Cu(NH_4)_2(SO_4)_2.6H_2O$ at liquid hydrogen temperatures as a function of a parallel and of a perpendicular static magnetic field. In a provisional theoretical discussion it is suggested that in parallel fields the absorption connected with the non-diagonal elements of the magnetic moment plays a dominating role. (auth)

1520

ON THE APPROACH TO EQUILIBRIUM OF A QUANTUM GAS. I. Prigogine and P. Résibois (Univ. of Brussels). Physica 24, 795-816(1958) Oct.

The approach to equilibrium of a quantum gas was studied at low enough concentration to be described by the perfect gas model (Bose-Einstein or Fermi-Dirac). The effect of statistics especially is studied completely. It is shown that next to well-known terms describing the effect of statistics on the final state (which are taken into account in the equation of Uehling-Uhlenbeck) exist other terms due to the effect of statistics on intermediary states. One development of a virial series is given for the transition probability. Just as the equilibrium properties of a quantum gas present some collective aspects giving, for example, rise to the Bose-Einstein condensation, the kinetic properties become here some complicated function of the state of the system (therefore, of the temperature and of the density) and can not be expressed with only the aid of the cross section of binary collision. (T.R.H.)

1521

THE COLLECTIVE TREATMENT OF A FERMI GAS: I. S. F. Edwards (Univ. of Birmingham, Eng.). Proc. Phys. Soc. (London) 72, 685-9(1958) Nov.

The collective approach to a Fermi gas is discussed by considering the wave functions of non-interacting Fermi gases in one and three dimensions, and of the interacting Fermi gas. It is shown how to write the one-dimensional case exactly in terms of collective coordinates, and how these have a well defined existence for long wavelengths even without interaction. This is extended as far as possible to three dimensions, and it is shown how the statistics affect the collective motion in the presence of interaction. A brief discussion is given of how calculations may be performed when redundant sets of coordinates are used. (auth)

1522

MAGNETIC SUSCEPTIBILITY AND ELECTRICAL RESISTANCE PROPERTIES OF SOME URANIUM ALLOYS. L. F. Bates and R. G. Loasby (Univ. of Nottingham, Eng.). Proc. Phys. Soc. (London) 72, 757-64 (1958) Nov.

The magnetic susceptibilities and electrical properties of a series of quenched alloys of uranium with zirconium, niobium and molybdenum, metals which have four, five, and six outer electrons respectively, were measured over the temperature range 90 to 300°K. The general features of the three systems are the same, with anomalies at about 0.5 and 2.0 at. % of the solute. The first anomaly is of unknown origin, and the second suggests that alloys containing up to about 2 at. % of the solute may be obtained in the α-form by quenching them from the γ-phase field, and that within this composition range the behavior is consistent with the full Brillouin zone structure proposed for α-uranium. (auth)

1523

THE ELECTRICAL BREAKDOWN OF GASES IN UNIFORM HIGH FREQUENCY FIELDS AT LOW PRESSURE. W. G. Townsend and G. C. Williams (University Coll. of Swansea). Proc. Phys. Soc. (London) 72, 823-32(1958) Nov.

Electrical breakdown in air and in hydrogen for uniform high frequency and static fields was investigated using a pair of geometrically similar electrode systems. Static breakdown potentials for values of pd $\leq$ 15 mm Hg cm were measured, and high frequency data were obtained over a range of frequencies f from 5 Mc/s to 70 Mc/s. The results support the view that there is only one mode of breakdown, contrary to the views proposed by many previous workers. The similarity relationship was found to be satisfied for certain pairs of frequencies provided that the discharge was confined to the regions of uniform field between the electrodes, and that the electrode surfaces were clean. On the other hand, when the electrodes were covered with oxide layers, the similarity theorem did not apply. This result indicates that at least one process of electron generation or loss was not a function of E/p; the most probable process, cold emission, was identified by correlating the results with those obtained under similar conditions with static fields. (auth)

1524

THE POLARIZATION OF HELIUM-LIKE ATOMS. A. Dalgarno (Queen's Univ. of Belfast). Proc. Phys. Soc. (London) 72, 889-91(1958) Nov.

Adopting the approximation method of Sternheimer (1954), polarization data were obtained for the helium iso-electronic sequence. The data are given and compared with data obtained by later and more accurate methods. The comparison indicates the approximation method introduces errors of the order of 15%. (D.E.B.)

1525

POLARIZATION OF RESONANTLY SCATTERED γ-RAYS. V. Knapp and B. S. Sood (Univ. of Birmingham, Eng.). Proc. Roy. Soc. (London) A247, 369-74 (1958) Sept. 30.

Polarization of the Au^{198} 411-kev γ rays, resonantly scattered in Hg^{198}, has been demonstrated with a polarimeter which uses Compton scattering as analyzing process. The resonance radiation was found to be strongly polarized with its electric vector parallel to the scattering plane, which confirms the E2 character of the 411 kev transition in Hg^{198}. (auth)

1526

POLARIZATION OF 0·411, 0·662 AND 1·25 Mev γ-RAYS ELASTICALLY SCATTERED BY LEAD. B. S. Sood (Univ. of Birmingham, Eng.). Proc. Roy. Soc. (London) A247, 375-80(1958) Sept. 30.

The polarization of 0.411, 0.662, and 1.25 Mev γ rays elastically scattered by lead at 90° has been studied with a γ-ray polarimeter using Compton scattering as the analyzing process. At these energies and this angle the only processes contributing to elastic scattering are nuclear Thomson scattering and Rayleigh scattering. Since the intensity and polarization of the Thomson component are readily calculable, the measurements provide a check of theories of Rayleigh scattering. The experimental results contradict the predictions of the form factor calculations and agree with those of the refined numerical calculations of Brown & Mayers. (auth)

1527

A TENTATIVE INTERPRETATION OF THE RESULTS OF OF RECENT X-RAY AND INFRA-RED STUDIES OF LIQUID WATER AND $H_2O + D_2O$ MIXTURES. C. L. van Panthaleon van Eck, H. Mendel, and J. Fahrenfort (Koninklijke/Shell-Laboratorium, Amsterdam). Proc. Roy. Soc. (London) A247, 472-81(1958) Oct. 21.

An idealized model is proposed for the arrangement of the molecules in liquid water which involves essentially a sixfold co-ordination of water molecules with four short OH...O hydrogen bonds of ~ 2·9 A length and two long O...O contacts of ~ 3·6 A length. An ice-like structure may contribute to a small extent also. This octahedral model was based on evidence obtained from x-ray and infra-red absorption measurements.
The model was found to be in agreement with the density of water and the melting entropy of ice. The reliability of the radial distribution curves W(r) of liquid water obtained from recent x-ray diffraction measurements is discussed. Infra-red absorption measurements were made of liquid HDO in excess D_2O and H_2O, respectively. The respective O—H and O—D stretching vibration frequencies of liquid HDO were determined. The position (at 3400 cm^{-1}) and shape of the relatively sharp single O—H stretching absorption band of liquid HDO is closely comparable to the corresponding band in liquid interbonding alcohols. The results of the infra-red studies indicate an OH...O distance of 2·86 A in liquid water at room temperature. (auth)

1528

GENERALIZED RETARDED PRODUCTS. J. C. Polkinghorne (Univ. of Edinburgh). Proc. Roy. Soc. (London) A247, 557-61(1958) Oct. 21.

The generalization of the retarded commutator previously introduced (Polkinghorne 1957^b) is discussed. A proof of its causal property and a new proof of its relation to S-matrix elements are given. This latter provides a generalization of the work of Lehmann, Symanzik & Zimmermann (1957). (auth)

1529

DOSE FOR NONELECTRONIC EQUILIBRIUM CONDITIONS. Wm. C. Roesch (General Electric Co., Richland, Wash.). Radiation Research 9, 399-410(1958) Oct.

The exposure dose of x and γ-rays is very nearly equivalent to the kinetic energy of the ionizing rays they release per unit mass (KERM) in air. The KERM at a point is related to the absorbed dose at nearby points by means of an influence function. The influence function is used to find the difference between the KERM and the absorbed dose due to lack of electronic equilibrium resulting from exponential absorption and inverse square. When the difference is small, it can be calculated accurately. The free-air chamber is analyzed to show its relation to a cavity extrapolation chamber. The KERM concept can be applied to all radiations emitted in matter. It is a useful concept when the mean free path of the nonionizing rays emitted is very large compared to the range of the ionizing rays. (auth)

1530

DOSE DISTRIBUTION ABOUT LARGE CIRCULAR AND LINEAR SOURCES OF GAMMA RADIATION. I. F. Hummon and Robert S. Landauer (Cook County Hospital, Chicago). Radiology 71, 716-22(1958) Nov.

The distribution of radiation from circular and linear sources was investigated. From these studies it appears that an extended circular source 2 meters in diameter can be used to obtain uniform radiation throughout a segment of the body. The addition of radial fins of absorbing material makes it possible to reduce the intensity of radiation at the surface of a body in relation to that at the center of the body, thus approximating the results obtained with rotational therapy. The dose distribution about a linear source is similar for different source lengths provided proportionate distances in relation to the source length are used. Data for distances as close as 1.25 per cent of source length are presented. (auth)

1531

POSITIVE-FEED FLUID PUMP WITH VARIABLE FLOW RATE. Graeme P. Welch (Univ. of California, Berkeley). Rev. Sci. Instr. 29, 895-6(1958) Oct.

A positive-feed fluid pump with variable flow rate is described. The pump is designed to feed a nutrient solution to a continuously growing microbial culture. With a driving motor geared to 1 rpm, the pump affords flow rates between 1.8 and 7.0 ml/hr. Other ranges are obtained by changing driving motors. (A.C.)

1532

DOSIMETRY OF RADIOISOTOPES. A. J. Bertinchamps and G. C. Cotzias (Brookhaven National Lab., Upton, N. Y.). Science 128, 988-90(1958) Oct. 24.

A nomogram is presented which permits the estimation of the radiation dose delivered by 30 isotopes of biological interest. Large working copies of this nomogram are available from the authors. (C. H.)

1533

SUBCRITICAL AND CRITICAL FLOW THROUGH STRAIGHT-THROUGH, ELBOW, AND TEE A-N FITTINGS AND SHARP-EDGED ORIFICES AT ELEVATED TEMPERATURES. A. L. Duncoffe, J. R. Bennett, and C. G. Ray (Georgia Inst. of Tech., Atlanta). Trans. Am. Soc. Mech. Engrs. 80, 1349-57(1958) Oct.

The results of an investigation are presented of the flow through straight-through, elbow, and tee A-N standard fittings at negligible approach velocity with approach temperatures up to 1100°F and head pressures up to 60 psia. The element pressure ratio, i.e., the ratio of downstream to upstream static pressure across the test element, was varied between 1.0 and approximately 0.25. Empirical equations for the subcritical and critical flow regimes are derived for the rate of weight flow as a function of element pressure ratio, flow area, and approach temperature and pressure. Empirical equations for a given geometry are derived for a flow factor which is shown to be a function of pressure ratio only in both the subcritical and critical regions. In addition, previous work at room temperature on the flow through sharp-edged orifices in the subcritical and critical regimes has been extended to include a variation of approach temperature up to 1100°F. (auth)

1534

THE DETERMINATION OF THE ACTIVE X-RAY ENERGY IN A MATERIAL FROM IONIZATION MEASUREMENTS IN AIR. R. Glocker (Technische Hochschule, Stuttgart). Z. Physik 152, 521-37(1958). (In German)

The measurement conditions for the determination of the x-ray energy in a given layer of material from an air ionization measurement were derived. It was determined that an ionization measurement does not have a "dosimetric" significance in all cases. The advantages and disadvantages of a change of the definition of the dose unit "roentgen" were discussed. (tr-auth)

1535

THE EFFECT OF SATURATION OF THE PARAMAGNETIC RESONANCE ABSORPTION ON THE FARADAY EFFECT. EXPERIMENT ON NEODYMIUM ETHYL SULFATE. H. Wesemeyer and J. M. Daniels (Univ. of British Columbia, Vancouver). Z. Physik 152, 591-8 (1958). (In German)

The Faraday effect on $Nd(C_2H_5SO_4)_3 \cdot 9H_2O$ was studied at simultaneous saturation of the paramagnetic resonance of the Nd^{3+} ions at 1.4°K with $s' = \frac{1}{2}$, $g = 3.6$, $v = 9060$ megahertz, and $H = 1.8$ kgauss. A 50, 88, and 100% decrease of the Faraday effect was found. A formula was given with which the relaxation time can be calculated from the relative change of the Faraday effect. (tr-auth)

1536

ON APPLICABILITY OF MASSEY'S ADIABATIC HYPOTHESIS TO DOUBLE CHARGE EXCHANGE PROCESSES. Ya. M. Fogel, R. V. Mitin, V. F. Kozlov, and N. D. Romashko (Inst. of Physics and Technology, Academy of Sciences, Ukrainian S. S. R.). Zhur. Ekseptl'. i Teoret. Fiz. 35, 565-73(1958). (In Russian)

An analysis of the ion velocity dependence of effective cross sections for double charge exchange of some types of ions in inert gases shows that the position of the maximum of respective curves corresponds to Massey's adiabatic criterion. In carrying out the analysis, account should be made of the existence of excited ions in the primary beam as well as of the formation of slow excited double charged ions. As in the case of the ordinary type of charge exchange, the constant a in the case of double charge exchange weakly varies from one ion-molecule pair to another. The mean value of a for double charge exchange in inert gases is 1.5 A. The value of a for double charge exchange in molecular gases sharply differs from this value. (tr-auth)

1537

ON THE TEMPERATURE STABILITY OF THE DOMAIN STRUCTURE IN IRON SILICATE CRYSTALS. L. V. Kirenskii and I. F. Dekhtyarev (Inst. of Physics, Siberian Branch of the Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 584-6(1958). (In Russian)

The meridian magneto-optical Kerr effect was employed to investigate the domain structure of 3% iron silicate in the temperature range from 20 to 700°C. It is shown that in the indicated range the domain structure is highly stable. (tr-auth)

1538

INTERACTION BETWEEN A CHARGED CURRENT CARRYING JET MOVING IN A CIRCLE AND A MAGNETODIELECTRIC. A. N. Didenko (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 655-61(1958). (In Russian)

The radiation spectrum of a jet moving in a circle in homogeneous space is studied. The radiation spectra and lateral forces exerted by the magnetodielectric are investigated for some particular cases of inhomogeneous spaces with the help of the expressions for the Bessel functions and Neuman functions which yield a good approximation at comparatively small values of the indices. (tr-auth)

1539

OSCILLATIONS OF THE CONDUCTIVITY OF METALLIC FILMS IN MAGNETIC FIELDS. V. L. Gurevich. Zhur. Eksptl'. i Teoret. Fiz. 35, 668-77 (1958). (In Russian)

Conductivity oscillations in a metallic film located in a magnetic field are considered for an arbitrary dispersion law of electron energy and for arbitrary orientation of the field. The oscillations are not a quantum effect and are due to the finite thickness of the film and to the diffuse nature of electron reflection from its surface. In distinction to the Shubnikov —de Haas effect, the conductivity in the given case oscillates as a function of H but not of H^{-1}. Measurements of the oscillation amplitudes and periods permit one to draw conclusions regarding the shape of the Fermi surface in metals. (tr-auth)

1540

ON THE STABILITY OF SHOCK WAVES IN MAGNETO-

HYDRODYNAMICS. A. I. Akhiezer, G. Ya. Luibarskii, and R. V. Polovin (Inst. of Physics and Technology, Academy of Sciences Ukrainian SSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 731-7(1958). (In Russian)

The regions of nonstability of a stationary magnetohydrodynamical shock wave with respect to one-dimensional perturbations were determined. It is shown that two types of stable shock waves exist. The types of shock waves which can follow each other are ascertained. (tr-auth)

1541

SOME STATIONARY RELATIVISTIC MOTIONS OF A GAS IN A CONDUCTING MEDIUM. K. P. Stanyukovich (Bauman Moscow Technical School). Zhur. Eksptl'. i Teoret. Fiz. 35, 762-5(1958). (In Russian)

Quasi one-dimensional relativistic stationary gas flows in a medium possessing an infinitely high conductivity are considered for the case when a magnetic field perpendicular to the velocity. In particular motions with cylindrical symmetry are considered. The total momentum (equal to the "reactive" force) which an expanding gas can acquire in the presence or absence of a field is calculated. In particular the magnitude of the momentum during the outflow of an ultrarelativistic gas is considered. (tr-auth)

1542

CHERENKOV RADIATION EMITTED BY A CHARGED PARTICLE PASSING THROUGH A FERRODIELECTRIC SUBSTANCE. V. G. Baryakhtar and M. I. Kaganov (Inst. of Physics and Technology, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 766-70(1958). (In Russian)

Cherenkov radiation from a charged particle moving in a medium with a gyrotropic magnetic permeability is considered. Losses due to excitation of spin waves by the particle are calculated. (tr-auth)

1543

SPIN WAVES IN A FERROMAGNETIC METAL. A. A. Abrikosov and I. E. Dzyaloshinsky (Inst. of Problems in Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 771-5(1958). (In Russian)

Spin waves in a ferromagnetic metal are examined on basis of Landau's theory of the Fermi fluid. (tr-auth)

1544

REMARKS ON THE STRUCTURE OF SHOCK WAVES. G. S. Golitsyn and K. P. Stanyukovich (Bauman Technical School). Zhur. Eksptl'. i Teoret. Fiz. 35, 828-30 (1958). (In Russian)

Previously it was shown that in a high-conductivity and low-viscosity gas the entropy passes through the maximum. Moreover, the gas velocity in the coördinate system connected to the break is equal to the local sound velocity. It is shown that such coincidence is possible in other instances. (R.V.J.)

1545

MASS SPECTROSCOPY. Henry E. Duckworth. New York, Cambridge University Press, 1958. 219p.

The principles which govern the operation of mass spectroscopes are described, including the schemes which have been used to obtain mass resolution and dispersion and the methods which have been devised for the production and detection of positive ion beams. The many applications of mass spectroscopy in physics are described in some detail, as are those in geophysics and in certain branches of chemical physics. Tables of isotopic abundances and atomic masses, plus an extensive bibliography are included. (W.D.M.)

Elementary Particles

1546 CEA-674

France. Commissariat à l'Énergie Atomique, Paris.
MESURE DE L'AIRE DE RALENTISSEMENT DES NEUTRONS DANS LE GRAPHITE DE 1,45 eV A L'ETAT THERMIQUE. (Measure of the Slowing Down Area of 1.45-ev Neutrons to the Thermal State in Graphite.) Claude Robert. 1957. 28p.

The life of a fast neutron in a moderating medium may be divided into two parts: At first it is slowed by collisions with the nuclei of the medium, then, when its energy is in the thermal range, it diffuses until its capture. The determination of the distribution of thermal neutrons from the distribution of fast neutrons is examined on the basis of the distribution of nascent thermal neutrons and the law of scattering. The graphite used as the moderator was of such size that it would be considered infinite. (J.S.R.)

1547 NEVIS-30

Columbia Univ., Irvington-on-Hudson, N. Y. Nevis Cyclotron Labs.
RADIATIVE BETA DECAY OF THE PION (thesis). S. Lokanathan. Mar. 1957. 50p. Contract N6-ori-110-Task No. 1. (CU-120-57-ONR-110-1-Phys.) $7.80(ph OTS); $3.30(mf OTS).

Previous studies have shown that the branching ratio $\rho = (\pi^+ \rightarrow e^+ + \nu)/(\pi^+ \rightarrow \mu^+ + \nu) \underset{\sim}{\nu} 10^{-4}$. This method assumed a two-body decay for the mode π-e and looked only for electrons of about 70 Mev. Selection rules which are unfavorable to this process may be relaxed when a photon accompanies the decay. Earlier experiments had set a limit of $\sim 10^{-3}$ for the probability of the decay $\pi^+ \rightarrow e^+$ + neutral particles. An experiment was performed using scintillation counters to try to detect the mode $\pi^+ \rightarrow e^+ + \gamma + \nu$ by looking for e, γ coincidences at 180° and at 90°. The upper limit for the ratio $\rho_\gamma = (\pi^+ \rightarrow e^+ + \gamma + \nu)/(\pi^+ \rightarrow \mu^+ + \nu)$ depends on the expected form of the e, γ angular correlation. For an angular correlation obtained from phase space considerations alone, the result is $\rho_\gamma \lesssim 2.6 \times 10^{-5}$. For the particular angular correlation predicted when the decay is assumed to occur via an intermediate nucleon anti-nucleon pair through a tensor Fermi interaction, the result is $\rho_\gamma \lesssim 1.8 \times 10^{-5}$. The theoretical prediction for this case gives both the shape and the amplitude of the angular distribution and leads to a predicted $\rho_\gamma \sim 0.025$ which is many orders of magnitude larger than the experimental value. (auth)

1548 NP-6999

Joint Inst. for Nuclear Research, Moscow. Lab. of High Energy.
ON A POSSIBLE EXISTENCE OF Ξ^0-HYPERON. E. O. Okonov. 1958. 5p.

In connection with the possible existence of the neutral cascade particle Ξ^0, the appreciable difference between the mean lifetime of the Λ^0-particles observed in cosmic rays and those obtained with an accelerator is considered. It is postulated that the Ξ^0-particle decays by the reaction $\Xi^0 \rightarrow \Lambda^0 + \pi^0$ with a change in strangeness $/\Delta S/ = 1$. (W.D.M.)

1549 NP-7019

Pittsburgh. Univ.
CHARGE TRANSFER FOR PROTONS IN H_2. R. Curran, T. M. Donahue, and W. H. Kasner. Technical Report No. 7 [on] CAPTURE-LOSS AND IONIZATION CROSS-SECTIONS OF IONS AND NEUTRAL PARTICLES. Oct. 1958. 24p. Contract Nonr-624(06).

A precise measurement of the electron capture cross section for protons in H_2 is reported for proton energies between 2.4 and 60 kev. The method involves collection of the residual ions by a sequence of identical condensers. The same scattering chamber is also used for the measurement of σ_{01} and $(\sigma_{01} + \sigma_{10})$. Recent measurements of Stier and Barnett are in close agreement with the results obtained. (auth)

1550 UCRL-3783
California. Univ., Berkeley. Radiation Lab.
A STUDY OF THE INTERACTION OF POSITIVE K MESONS (thesis). Joseph Edward Lannutti. May 15, 1957. 107p. Contract W-7405-eng-48. $16.80(ph OTS); $5.70(mf OTS).

The interaction of positive K mesons having energies between 20 to 220 Mev with the nuclei of photographic emulsion was investigated. 237 meters of K meson track were followed and 282 inelastic scatters were found. An additional 61 meters of track were followed to search for more K-hydrogen scatters. A total of 15 K-hydrogen events was found. No case was found in which the K meson lost its rest mass energy in an inelastic interaction. This result supports the concept of conservation of strangeness in fast interactions. Adding the observed K-hydrogen scatters to the 28 events found by other laboratories at energies above 20 Mev the K-p cross section is found to be 14.9 ± 2.3 mb for energies between 20 to 200 Mev. The energy dependence and angular distribution of the K-p scatters are consistent with S wave scattering. The inelastic scattering cross section increases with energy. However, the average K-nucleon cross section is shown to be practically constant at 11 mb for energies from 20 to 180 Mev. The charge exchange cross section is somewhat energy dependent and varies from $2.9 \pm ^{1.4}_{1.0}$ mb at 70 Mev to 4.0 ± 0.9 mb at 150 Mev. The angular distribution of the inelastic scatters, assuming that they are scatters from single nucleons in the nucleus, peaks backward in the center of mass system. This effect is very pronounced above 100 Mev and is probably due to direct neutron scattering since the K-hydrogen scatters appear to be isotropic. Preliminary results on the analysis of the differential elastic scattering cross sections indicate best agreement with a repulsive potential of about 10 Mev for energies below 100 Mev. The energy loss behavior of K mesons in inelastic scatters shows strong agreement with that expected for a repulsive potential. The energy loss-angle correlations support the assumption that the K-nucleus interaction can be described in terms of single nucleon scatters. The average energy loss of K mesons agrees with the average nuclear excitation for stars caused by K's having energies between 100 to 220 Mev. Analysis of the data in terms of scattering amplitudes shows that the S wave scattering is predominantly in the T = 1 state but the T = 0 state is not negligible. P wave scattering is shown to be important in the T = 0 state. It is predicted that the charge exchange angular distribution peaks forward. Preliminary data in this connection agree. (auth)

1551 UCRL-5317-T
California. Univ., Livermore. Radiation Lab.
NUCLEON-NUCLEON SCATTERING AND THE ONE-PION EXCHANGE. Michael J. Moravcsik. Aug. 11, 1958. 5p. Contract W-7405-eng-48. $0.50(OTS).

A new scheme is proposed to interpret nucleon-nucleon scattering, based on the explicit separation of the one-pion exchange contribution. This scheme requires approximately half as many parameters to characterize scattering as the conventional phase-shift analysis does. Thus the scheme is likely to lead to greater accuracy, less ambiguity, and a more lucid connection between experimental quantities and detailed theoretical calculations. One of the parameters directly resulting from the new analysis is the pion-nucleon coupling constant. (auth)

1552
ANNIHILATION OF POLARIZED POSITRONS IN FERROMAGNETIC MATERIALS. I. Lovas (Central Research Inst. of Physics of the Hungarian Academy of Sciences). Acta Phys. Acad. Sci. Hung. 8, 441-5(1958).

Most positrons lose their energies when entering a metal and after slowing down reach thermal energies corresponding to the metal temperature. It is presumed that a positron having this extremely small momentum interacts with an electron at rest. In the annihilation two photons of energy MC^2 are produced. (A. C.)

1553
ON THE DECAY OF POSITIVE K-MESONS. P. Suranyi (Central Research Inst. of Physics of the Hungarian Academy of Sciences, Budapest). Acta Phys. Acad. Sci. Hung. 8, 447-9(1958).

The six known decay modes of K mesons are tabulated and shown to be consistent with a proposal that only two K particles, τ and Θ, exist. It is furthur proposed that τ decay happens through a virtual Θ meson. (D.E.B.)

1554
INVESTIGATIONS ON THE POSSIBLE DEFLECTION OF A THERMAL NEUTRON FLUX. II. Helmut Völcker (Univ. of Kiel). Atomkern-Energie 3, 389-94(1958) Oct. (In German)

The article on a method for the possible deflection of thermal neutron beams is concluded with a discussion of the reflection possibility as a function of layer thickness and geometry. (J.S.R.)

1555
AIR SHOWERS OF SIZE GREATER THAN 10^5 PARTICLES. 3. COMPARISON BETWEEN THE RESPONSE OF GEIGER COUNTERS AND SCINTILLATION COUNTERS. M. H. Brennan, D. D. Millar, M. H. Rathgeber, and C. S. Wallace (Univ. of Sydney). Nature 182, 1053-4(1958) Oct. 18.

Observations are reported on air shower particle size and position of the core made with an array of scintillation counters and checked by the response of a tray of Geiger counters. The results of the analysis provide a method of comparing estimates of shower sizes obtained by different types of detectors. (C.H.)

1556
LEVEL DENSITY OF DEGENERATE FERMI SYSTEMS. Torleif Ericson (NORDITA, Copenhagen). Nuclear Phys. 8, 265-83(1958) Oct. (1)

Model independent expressions for the level density of systems of non-interacting Fermions are given in a form suitable for treating degenerate systems. No formal distinction is made between discrete and continuous distribution of the single Fermion states. The explicit solution as well as approximate formulas in various limiting cases are given for the case when the single Fermion distribution can be analyzed in a power series or a Fourier series. As an application the effect of nuclear shell structure on the level density is estimated. Finally, the influence on the level density of an energy gap in the single Fermion spectrum is discussed. It is shown that the introduction of an energy gap can account for the observed difference in level densities of nuclei with odd and even number of nucleons. (auth)

1557

SCATTERING OF POLARIZED ELECTRONS BY A COULOMB FIELD. M. Bernardini, P. Brovetto, and S. Ferroni (Istituto Nazionale di Fisica Nucleare, Turin). Nuclear Phys. 8, 294-302(1958) Oct. (1)

In this work some equations, concerning the cross-section and polarization of a fermion beam scattered by a central field, are obtained by means of the density matrix formalism. These equations are applied to the case of electrons scattered in a Coulomb field. The precession of the polarization is given as a function of velocity for some values of the parameters. The double scattering experiment in orthogonal planes is discussed as a technique for evaluating the longitudinal component of the electron polarization. (auth)

1558

SOME PROBLEMS ENCOUNTERED IN THE THEORY OF THE DISPERSION RELATIONS. A. A. Logunov and A. N. Tavkhelidze (Joint Inst. of Nuclear Research, Dubna, USSR). Nuclear Phys. 8, 374-93(1958) Oct. (1)

Dispersion relations are obtained for a reaction involving a variable number of particles (a fermion and boson prior to the reaction and a fermion and two identical bosons after the reaction). Cases are indicated for which an unobservable energy region is absent in the dispersion relations. A justification of the dispersion relations in the absence of an unobservable energy region is presented for the particular process $\gamma + p \rightarrow 2\gamma + p$. (auth)

1559

THE USE OF MAGNETIC MODELS IN THE INTERPRETATION OF DOMAIN EFFECTS ON AN ELECTRON BEAM. M. Blackman and N. D. Lisgarten (Imperial Coll., London). Phil. Mag. (8) 3, 1069-73(1958) Oct.

A magnetic unit was constructed which consists of an array of oppositely magnetized steel wires and its effect on an electron beam was studied. The phenomena observed are similar to the domain effects found when magnetic crystals are examined in the same apparatus, and are used in interpreting some of the features of the domain effects. (auth)

1560

FERMI-THOMAS MODEL WITH CORRELATIONS. H. W. Lewis (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 111, 1554-7(1958) Sept. 15.

The Fermi-Thomas-Dirac equation is modified to include correlations between electrons. An application is made to the equation of state. No numerical work with the modified equation is reported. (auth)

1561

CHARGE INDEPENDENCE AND THE LOW-ENERGY PARAMETERS IN PION PHYSICS. Michael J. Moravcsik (Univ. of California, Livermore). Phys. Rev. 111, 1657-8(1958) Sept. 15.

It is pointed out that the striking discrepancy among the very low-energy parameters in pion physics might be resolved by considering deviations from charge independence. An accurate set of measurements of the total cross section for charge exchange scattering at low energies is needed to prove or disprove this contention. (auth)

1562

PION PRODUCTION IN HIGH-ENERGY PROCESSES. Suraj N. Gupta (Wayne State Univ., Detroit). Phys. Rev. 111, 1698(1958) Sept. 15.

It is shown that the high-energy experiments on pion production favor rather than rule out the possibility of the existence of a new highly unstable neutral scalar meson (the ρ^0 meson). (auth)

1563

Σ^0 MASS. M. Lynn Stevenson (Univ. of California, Berkeley). Phys. Rev. 111, 1707-9(1958) Sept. 15.

The mass of the Σ^0 hyperon is obtained from a single associated production event in which both strange particles are observed to decay. The event is unusual, first because the Σ^0 hyperon decays directly into an electron-positron pair plus a Λ, and secondly because all the tracks are long and of higher-than-average quality. The value of Q_Σ obtained from this event is 76.4 ± 3.3 Mev, where $Q_\Sigma \equiv M_{\Sigma^0} - M_\Lambda$. For $M_\Lambda = 1115.2 \pm 0.14$ Mev the mass of the Σ^0 is 1191.6 ± 3.3 Mev. Upon averaging this value with the existing measurements of Alvarez et al. and Eisler et al., one obtains $Q_\Sigma = 75.3^{+0.9}_{-1.4}$ Mev and hence $M_{\Sigma^0} = 1190.5^{+0.9}_{-1.4}$ Mev. (auth)

1564

PHOTOMESON PRODUCTION IN INTERMEDIATE COUPLING. Kurt Haller (Columbia Univ., New York). Phys. Rev. 111, 1736-45(1958) Sept. 15.

The wave functions for the ground state of a physical nucleon and for the scattering state of a physical nucleon and a pion are used to compute photopion production cross sections in an intermediate-coupling approximation. Since the mesons included in the physical nucleon suffice to account for an approximately correct value of the anomalous magnetic moment, no use is made in this theory of a correction term involving experimental values of the latter. The p-wave part of the photoproduction matrix element is arrived at naturally, largely from the interaction of the meson currents with the electromagnetic field. Differential cross sections are obtained for the production of π^+ and π^0 by photons of 200, 260, 335, and 440 Mev in the laboratory system. It is also pointed out that in the intermediate-coupling theory, the ambiguity in defining a gauge-invariant Hamiltonian is nontrivial. Different procedures for generalizing the meson-nucleon interaction term into a form that is gauge invariant in an extended-source theory lead to substantially different p-wave components of the photoproduction cross sections. (auth)

1565

$\beta-\gamma$ ANGULAR CORRELATION EXPERIMENTS AND TIME-REVERSAL INVARIANCE OF THE BETA INTERACTION. P. C. Simms and R. M. Steffen (Purdue Univ., Lafayette, Ind.). Phys. Rev. Letters 1, 289-90 (1958) Oct. 15.

The Au^{198} sources ($5\mu g/cm^2$) were prepared by evaporation on an aluminum foil backing ($180\ \mu g/cm^2$). The beta-gamma directional correlation of Au^{198} was observed with a multichannel scintillation coincidence spectrometer. The results, corrected for finite energy resolution, backscattering in the β crystal, etc., are shown. (W.D.M.)

1566

STRUCTURE OF MESONS. Henry P. Stapp (Univ. of California, Berkeley). Phys. Rev. Letters 1, 296-8 (1958) Oct. 15.

A model of the π and K mesons based upon a direct point interaction was examined in the approximation in which radiative corrections are neglected. These corrections are eliminated by modifying the Hamiltonian. The modified problem is then solved exactly. A momentum cutoff is required, but this parameter and the coupling constant are determined by the experimental values of the meson mass and the meson-baryon coupling constant. (W.D.M.)

1567

TEST OF TIME-REVERSAL INVARIANCE OF THE BETA INTERACTION IN THE DECAY OF FREE POLARIZED NEUTRONS. M. T. Burgy, V. E. Krohn, T. B. Novey, and G. R. Ringo (Argonne National Lab., Lemont, Ill.) and V. L. Telegdi (Univ. of Chicago). Phys. Rev. Letters 1, 324-6(1958) Nov. 1.

As a test of time-reversal invariance in the beta decay of free polarized neutrons, a search for the correlation between the electron momentum, the antineutrino momentum, and the polarization of the nucleus was carried out. An experiment to set an upper limit on the correlation is described. (W. D. M.)

1568

CIRCULAR POLARIZATION OF EXTERNAL BREMSSTRAHLUNG. A. Bisi and L. Zappa (Istituto di Fisica del Politecnico, Milan). Phys. Rev. Letters 1, 332-3 (1958) Nov. 1.

The sense and the degree of the polarization of external bremsstrahlung (maximum energy = 2.26 Mev) as a function of energy were investigated. The results were compared with a rough theoretical estimate. (W.D.M.)

1569

DETERMINATION OF THE π-π INTERACTION STRENGTH FROM π-N SCATTERING. C. Goebel (Univ. of Rochester, N. Y.). Phys. Rev. Letters 1, 337-9(1958) Nov. 1.

The role of π-π interaction in π-N scattering is considered, particularly in the pion production process. The effects that result from the π-π interaction are discussed. A quantitative estimate of the π-π interaction strength is obtained by isolating the contribution of the one-pion exchange diagram from all others. This is accomplished by using the fact that this matrix element becomes infinite when the exchanged pion is real. (W.D.M.)

1570

THE TRANSMISSION OF ELECTRONS THROUGH METALLIC FOILS. B. N. C. Agu, T. A. Burdett, and E. Matsukawa (Univ. of Leicester, Eng.). Proc. Phys. Soc. (London) 72, 727-32(1958) Nov.

Electron transmission measurements, using a collecting cup and galvanometers, were made for homogeneous energy beams in the range 0.25 to 0.75 Mev in foils of Be, Al, Cu, Ag, and Au. The discrepancy between the present measurement of extrapolated range in aluminum and the generally accepted range—energy relationship cannot be simply explained in terms of low energy secondary emission or geometrical effects. Transmission measurements through silver foils agree, however, with other published results. The angular distribution of electrons emerging from the exit side of a foil has been examined. This appears to approach a cosine distribution at low transmissions. Further information on range values, and some confirmation of voltage calibration were obtained from ionization in depth measurements. (auth)

1571

ENERGY DEPENDENCE OF THE SPATIAL ASYMMETRY IN POLARIZED MUON DECAY. J. M. Cassels, T. W. O'Keeffe, M. Rigby, and J. R. Wormald (Univ. of Liverpool). Proc. Phys. Soc. (London) 72, 781-5(1958) Nov.

The spatial asymmetry of the positrons from polarized muon decay was measured, with and without discrimination in favor of high energies. The high energy positrons were found to be more asymmetric than the average, and the effect is quantitatively consistent with the two-component neutrino theory. (auth)

1572

THE PHOTOPRODUCTION OF π^0 MESONS AT HELIUM. P. Palit and E. H. Bellamy (Univ. of Glasgow). Proc. Phys. Soc. (London) 72, 880-6(1958) Nov.

The elastic photoproduction of neutral mesons from helium was studied at center-of-mass angles of 70, 90, 115, and 135° for the meson in the photon energy range 220 to 320 Mev. The reaction was identified by detecting the recoiling He^4 particles in a pair of gridded ionization chambers which discriminated against other particles by dE/dx and E measurements. The measured cross sections are compared with the predictions of an impulse approximation calculation with which they are in qualitative agreement. They are smaller by an order of magnitude than some of the previous measurements of this reaction. (auth)

1573

THE PHOTOPRODUCTION OF CHARGED PIONS FROM DEUTERIUM. W. R. Hogg and E. H. Bellamy (Univ. of Glasgow). Proc. Phys. Soc. (London) 72, 895-8(1958) Nov.

Relative yields of π^- and π^+ mesons from deuterium were measured at 75° to a photon beam of maximum energy of 235 ± 5 Mev. Three energy ranges of pions were detected simultaneously, viz 11 to 15 Mev, 24 to 30 Mev, 44 to 51 Mev. The pions were produced in a liquid deuterium target. A double focusing magnetic spectrometer was used as a detector. Recent results of π^-/π^+ ratios from deuterium indicated a value greater than unity at low pion energies. (A.C.)

1574

MUON ANGULAR DISTRIBUTION FROM PION DECAY IN EMULSIONS. Carlo Castagnoli, Massimilliano Ferro-Luzzi, and Augusta Manfredini (Univ. of Rome and Istituto Nazionale di Fisica Nucleare, Rome). Ricerca sci. 28, 1644-9(1958) Aug.

An investigation on the angular distribution of μ mesons originating in π decays in nuclear emulsion was made. Measurements performed on 6978 mesons are discussed; the conclusion was that, if several instrumental effects are taken into account, any asymmetry is eliminated. These instrumental effects are discussed and the results compared with those obtained by other authors. (auth)

1575

ON NUCLEON-ANTINUCLEON SYMMETRY IN COSMOLOGY. Ralph A. Alpher (General Electric Research Lab., Schenectady, N. Y.) and Robert Herman (General Motors Corp., Detroit). Science 128, 904(1958) Oct. 17.

It has been suggested that cosmological models should embody an initial nucleon-antinucleon symmetry and that the present ratio of nucleons to antinucleons is the result of a statistical fluctuation. Simple arguments are presented for evolutionary models which appear to rule out this possibility in the development of the universe. (auth)

1576

INVESTIGATION OF THE ANGULAR DISTRIBUTION OF SECONDARY PARTICLES IN SHOWERS PRODUCED BY HIGH ENERGY NUCLEONS. L. A. Sanko, Zh. S.

Takibayev, and Ts. I. Shakhova. Zhur. Eksptl'. i Teoret. Fiz. 35, 574-83(1958). (In Russian)

The angular distribution of secondary shower particles produced in the stratosphere by nucleons with energies above 50 Bev is investigated. An analysis of the distribution is carried out on the basis of the theory of multiple production of mesons in collisions of nucleons with nucleons or with a column consisting of several nucleons in the target nucleus. (tr-auth)

1577

γ-RADIATION EMITTED IN RADIATIVE CAPTURE OF THERMAL NEUTRONS BY Mo^{95}, Ag^{107}, Te^{123} AND Cs^{133} NUCLEI. L. F. Kalinkin, A. S. Melioranskii, and I. V. Estulin (Research Inst. of Nuclear Physics, Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 592-8 (1958). (In Russian)

A single-crystal scintillation spectrometer adjusted for work at high counting rates was employed in the energy range from 20 to 1000 kev for measurement of the energy and absolute intensities of γ rays emitted during radiative capture of neutrons by samples enriched with isotopes of Mo^{95}, Ag^{107}, Te^{123}, and Cs^{133}. The γ rays detected are due to transitions between the lower excited states of the investigated nuclei. (tr-auth)

1578

INELASTIC INTERACTION BETWEEN COSMIC RAY PROTONS OF KINETIC ENERGIES ABOVE 7 BeV AND CARBON AND HYDROGEN NUCLEI. K. I. Alekseeva and N. L. Grigorov (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 599-611(1958). (In Russian)

Inelastic interaction between cosmic ray protons of kinetic energy above 7 Bev (mean energy ~20 Bev) and carbon and hydrogen nuclei was investigated at a geomagnetic latitude of 31°N in the stratosphere. Measurements were made with a telescope with a lead filter and the investigated graphite and paraffin filters and also with the hodoscope system of counters which surrounded the telescope and filters. The value 315 ± 50 mb was obtained for the proton—carbon nucleus inelastic interaction cross section. The proton—proton inelastic interaction cross section was 32 ± 10 mb. The average number of charged penetrating particles in showers from carbon was found to be 4.2 ± 0.5 particles per shower and ~3.4 particles per shower produced in hydrogen. (tr-auth)

1579

INVESTIGATION OF EXTENSIVE COSMIC RAY SHOWERS UNDER DENSE SUBSTANCES. S. I. Nikolskii and A. A. Pomanskii (Lebedev Inst. of Physics, Academy of Sciences USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 618-30(1958). (In Russian)

The absorption of extensive atmospheric shower particles in an absorber of low atomic number was investigated at an altitude of 3860 m above sea level. Data indicate that in the lower third part of the atmosphere about 60% of the energy of the nuclear active component is transferred to μ-mesons and neutrinos. Some of the data seem to indicate that the absorption of shower particles increases as one goes over to showers with a total number of particles $N > 10^6$. (tr-auth)

1580

ON THE SIZE DISTRIBUTION OF EXTENSIVE ATMOSPHERIC SHOWERS. G. V. Kulikov and G. B. Khristiansen (Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 635-40(1958). (In Russian).

Experimental data pertaining to the distribution of atmospheric showers with respect to the number of particles are presented for particle numbers ranging from 10^5 to 2×10^6. An analysis of these data and the published data available indicates that when the number of particles lies between 10^6 and 10^7 there is probably an irregularity in the shower size distribution curve. This is considered as an indication of the metagalactic origin of cosmic rays with energies $>10^{16}$ ev. (tr-auth)

1581

ELASTIC SCATTERING OF PHOTONS ON EXCITED NUCLEONS. N. F. Nelipa (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 662-7(1958). (In Russian)

The cross section for elastic scattering of γ quanta on nucleons is computed with account of the excited states of nucleons as described by the Markov model. The calculated cross section values are found to agree satisfactorily with the available experimental data. (tr-auth)

1582

ENERGY DEPENDENCE OF THE CROSS SECTIONS FOR MULTIPLE PRODUCTION REACTION NEAR THRESHOLD. A. F. Grashin (Moscow Inst. of Engineering Physics). Zhur. Eksptl'. i Teoret. Fiz. 35, 719-25(1958). (In Russian)

Threshold energy dependence of the cross section for the multiple creation of particles was derived with account of the Pauli principle and coulomb interaction between the emitted particles and the residual nucleus. In the general case recoil of the nuclei and coulomb interaction between the emitted particles were neglected. When not more than one of the emitted particles was charged, nuclear recoil was taken into account and the formulas thus obtained are exact ones. (tr-auth)

1583

ON THE Λ-HYPERON CREATION CROSS SECTION NEAR THE Σ-HYPERON CREATION THRESHOLD. A. I. Baz and L. B. Okun. Zhur. Eksptl'. i Teoret. Fiz. 35, 757-61(1958). (In Russian)

A peculiarity exists in the cross section of the $\pi^- + p \rightarrow K^0 + \Lambda^0$ reaction near the threshold of the reaction $\pi^- + p \rightarrow K_0 + \Sigma^0$. An experimental study of this peculiarity permits one to verify the validity of various model concepts regarding the interaction between strange particles and also to determine the relative parity of Λ- and Σ-hyperons. (tr-auth)

1584

NON-LOCAL EFFECTS IN WEAK INTERACTIONS OF FERMIONS. S. G. Matinyan (Inst. of Physics, Academy of Sciences, Georgian SSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 791-3(1958). (In Russian)

Non-local effects in processes of μ capture by protons are discussed. The neutrino is described by the two-component theory. (R.V.J.)

1585

ON β DECAY OF PARTICLES WITH 3/2 SPIN. R. A. Asanov (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 35, 796-8(1958). (In Russian)

The decay of a particle with $\frac{3}{2}$ spin is analyzed in relation to the possible existence of hyperon with larger than $\frac{1}{2}$ spin. β decay is studied in the scheme $Y \rightarrow p + e + \tilde{\nu}$, similar to the neutron decay scheme, by the first approximation theory of perturbations. It is assumed that the decay products obey the Dirac relation while the decaying particle obeys the Rarita-Schwinger relation. (R.V.J.)

1586

UNIVERSAL FERMI-INTERACTION AND μ MESON CAPTURE BY PROTONS. Ya. B. Zel'dovich and S. S. Gershtein (Leningrad Inst. of Physics and Technology, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 821-3(1958). (In Russian)

Spin correlations of μ mesons (or electrons) with protons were obtained visually, assuming that β decay (or μ capture) passes through the intermediate particle with spin 0. The interaction (V-A) corresponds to the neutral particle (ζ): $N \to \zeta + \tilde{\nu}$; $\zeta \to p + e^-$; and the interaction (V + A) corresponds to the charged particle (ζ'): $^-N \to \zeta' + e^-$; $\zeta \to p + \tilde{\nu}$. (R.V.J.)

1587

GENERATION OF π MESONS IN CONDENSED MEDIA BY COSMIC RAY PARTICLES IN STRATOSPHERE. D. K. Kaipov, V. N. Shakhvorostov, and Yu. G. Kosyak (Inst. of Nuclear Physics, Academy of Sciences, Kasakh SSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 825-6(1958). (In Russian)

Data are presented on the generation of very slow π mesons in condensed media irradiated by cosmic rays at 28 to 30 km elevation. Photoemulsions 10 cm in diameter and 400 μ thick were used as slow-meson detectors with aluminum and lead targets 12 × 12 cm of various thicknesses. Photoemulsions exposed for 12 hrs were microscopically scanned for $\pi \to \mu$ decay and σ capture. Corrections were made for the geometry of the experiment in order to obtain data for π meson production cross sections. Relative cross sections of meson production for various target thicknesses are tabulated. (R.V.J.)

1588

POSSIBLE METHOD FOR DETERMINING HYPERON POLARIZATION IN REACTION $\pi + p \to Y + K$. S. M. Bilen'kii and R. M. Ryndin (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 35, 827-8(1958). (In Russian)

A possible method is offered for determining the hyperon polarization in $\pi + p \to (\Sigma, \Lambda) + K$ and $K + p \to (\Sigma, \Lambda) + \pi$ reactions. The method includes the measurements of K(π) meson asymmetry in reactions with polarized protons. It is shown that the asymmetry, in this case, produces a direct hyperon polarization in reactions with non-polarized protons. (R.V.J.)

1589

1958 ANNUAL INTERNATIONAL CONFERENCE ON HIGH ENERGY PHYSICS AT CERN, GENEVA, 30th JUNE—5th JULY, 1958. B. Ferretti, ed. Geneva, CERN, Scientific Information Service, 1958. 364p. $10.47.

Forty-four papers and the discussion which followed the presentation of each are included. Major topics were nucleon structure, nucleon interactions, particle theory, strange particle production and interactions, and weak interaction modes. Separate abstracts have been prepared for each paper. (D.E.B.)

1590

NUCLEON STRUCTURE, EXPERIMENTAL. W. K. H. Panofsky (Stanford Univ., Calif.). pp. 3-19 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

Experimental information indicating the limits of quantum electrodynamic validity are presented and discussed. Specifically, experiments which define the limits of photon and electron propagator cut-offs are described. Experimental data obtained by various electron scattering processes are discussed in relation to the information given on neutron and proton electromagnetic structure. (D.E.B.)

1591

NUCLEON STRUCTURE, THEORETICAL I. S. D. Drell (Stanford Univ., Calif.). pp. 20-4 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

Isotopic scalar and vector form factors are defined and used in theoretical descriptions of elastic electron—proton scattering and inelastic and elastic electron—deuteron scattering. The process $e + p \to e' + p + \pi^0$ or $e' + n + \pi^+$ is then applied to a study of neutron electromagnetic structure. (D.E.B.)

1592

NUCLEON STRUCTURE, THEORETICAL II. S. D. Drell (Stanford Univ., Calif.). pp. 27-33 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

Theoretical attempts to interpret form factors are discussed. Of primary concern are recent dispersion attacks on the nucleon structure problem making use of a spectral representation of the form factors $F_1^{s,v}$ and $F_2^{s,v}$. An attempt to develop the value and structure of the isovector part of the magnetic moment, $G_2^v(q^2)$, is used to demonstrate the inadequacy of current theoretical methods. (D.E.B.)

1593

THE NUCLEON AND ITS INTERACTION WITH PIONS, PHOTONS, NUCLEONS AND ANTINUCLEONS; THROUGH $^3/_2$, $^3/_2$ RESONANCE, EXPERIMENTAL I. G. Puppi (Univ. of Bologna). pp. 39-59 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

Recent data are presented and discussed. Some of the experimental arrangements used in obtaining the data are shown. (D.E.B.)

1594

THE NUCLEON AND ITS INTERACTION WITH PIONS, PHOTONS, NUCLEONS AND ANTINUCLEONS; ABOVE $^3/_2$, $^3/_2$ RESONANCE, EXPERIMENTAL II. O. Piccioni (Brookhaven National Lab., Upton, N. Y.). pp. 65-86 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

Experimental results from a number of sources are presented on interactions at low kev to high Bev energies. The significance of the data is discussed. (D.E.B.)

1595

THE NUCLEON AND ITS INTERACTION WITH PIONS, PHOTONS, NUCLEONS AND ANTINUCLEONS, THEORETICAL I. G. F. Chew (Univ. of California, Berkeley). pp. 93-101 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

Published material is used in a summary of strong interaction characteristics, excluding strange particles. Some of the requirements of a successful strong interaction theory are given and compared with the present theories of static models and relativistic dispersion relations. (D.E.B.)

1596

THE NUCLEON AND ITS INTERACTION WITH PIONS, PROTONS, NUCLEONS AND ANTINUCLEONS. THEORETICAL II. G. F. Chew (Univ. of California, Berkeley). pp. 104-8 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

Various theoretical approaches to problems in nucleon—nucleon, nucleon—antinucleon, and nucleon—meson interactions are summarized and discussed. Attention is directed to some of the apparent successes and inconsistencies. The Breit, Signell-Marshak, Gammel-Thaler, Gartenhaus, Brown, and Cerulus-Hagedorn contributions are among those included. (D.E.B.)

1597

AN ATTEMPT AT A NON-LINEAR FIELD THEORY. H. Yukawa (Univ. of Kyoto). pp. 117-18 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

A recent attempt by Kita at a non-linear field theory is reviewed. Some of the many difficulties in the development of such a theory are discussed. (D.E.B.)

1598

RESEARCH ON THE NON-LINEAR SPINOR THEORY WITH INDEFINITE METRIC IN HILBERT SPACE. W. Heisenberg (Max-Planck Inst. fur Physi,, Gottingen). pp. 119-22 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

Recent developments in a non-linear spinor theory of matter are treated. The theory differs from conventional theories by the use of an indefinite metric in Hilbert space and by the introduction of dipole-ghost states. The equations of the theory are developed and tables are included which show the particle representations. (D.E.B.)

1599

THE INDEFINITE METRIC WITH COMPLEX ROOTS. W. Pauli (Univ. of Zurich). pp. 127-8 in "1958 Annual International Conference of High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

The indefinite metric with complex roots is discussed and compared with Heisenberg's dipole ghosts as a special case. (D.E.B.)

1600

ON A VARIANT OF THE THEORY WITH INDEFINITE METRIC. N. N. Bogolyubov (Joint Inst. for Nuclear Research, Dubna). pp. 129-30 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

Attention is drawn to some very simple and trivial possibilities of realizing Heisenberg's indefinite metric. (D.E.B.)

1601

ON THE LEE-MODEL. N. M. Kroll (Columbia Univ., New York). pp. 131-3 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

The Lee model is used in preliminary investigations of the consequences of the presence of two heavy particles instead of one. A specific application is made by considering the forces between one V particle and one N particle. (D.E.B.)

1602

FOUR-DIMENSIONAL EUCLIDEAN FORMULATION OF QUANTUM FIELD THEORY. J. Schwinger (Harvard Univ., Cambridge, Mass.). pp. 134-9 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

A possible avenue for the future development of quantum field theory is briefly discussed. The basis of this representation lies in the replacement of the Lorentz or Minkowski space by a Euclidean space. This substitution is defended by showing that all the physically significant mathematical representations are obtainable and actually goes beyond what can be obtained from the present theory of fields. (D.E.B.)

1603

RELATIVISTIC FIELD THEORY OF UNSTABLE PARTICLES. A. Salam and P. T. Matthews (Imperial Coll., London). pp. 141-2 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

The problem of creating a framework for the description of unstable elementary particles in relativistic local field theory is treated. The classical particle description is shown to lead to inconsistent complex masses and states which are inconsistent with the completeness relation. A restatement is proposed which is consistent with an eigenstate characterization. (D.E.B.)

1604

STRANGE PARTICLE PRODUCTION. J. Steinberger (Columbia Univ., New York). pp. 147-57 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

The results obtained at ten institutions doing bubble chamber studies of strange particle production are summarized. The discussion is limited to production cross sections and polarization effects in production. (D.E.B.)

1605

SOME COMMENTS ON ASSOCIATED Y-K PRODUCTION NEAR THRESHOLD BY PIONS AND PHOTONS. B. T. Feld (Massachusetts Inst. of Tech., Cambridge). pp. 158-9 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

Evidence is presented that the reactions (π or γ) + p → (Λ or Σ) + K, in the region of pion kinetic energies 0.8 to 1.4 Bev, are dominated by the resonances previously observed in the total π-p cross sections. Some general consequences of the resonant nature of these interactions are discussed. (D.E.B.)

1606

STRANGE PARTICLE PRODUCTION, THEORETICAL. M. Gell-Mann (California Inst. of Tech., Pasadena). pp. 162-3 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

A brief review of the theory of strange particle production is given, attention being drawn to areas where theoretical treatment is either inadequate or nonexistent. Some promising work on $\gamma + p \rightarrow K + \Lambda, \Sigma$ and $\pi + p \rightarrow K + \Lambda, \Sigma$ is included. (D.E.B.)

1607

CLASSIFICATION AND SYMMETRIES OF STRONGLY INTERACTING PARTICLES. B. d'Espagnat (CERN, Geneva). pp. 166-8 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

Assuming Yukawa interactions between baryons and mesons—and charge independence—the general strong interaction Lagrangian is written. Some of the many attempts by various investigations to make this Lagrangian more definite by reducing the number of independent coupling constants are then reviewed. (D.E.B.)

1608

STRANGE PARTICLE INTERACTIONS, EXPERIMENTAL. M. F. Kaplon (Univ. of Rochester, N. Y.). pp. 171-83 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

Experimental results from a number of investigations of K^+, K^0, K^-, and hyperon interactions were collected and are summarized. The experimental data support the isotopic multiplet structure of Gell-Mann and Nishijima for the mesons and baryons and the conservation laws for strong interactions. It appears that the K mesons are bosons of unknown parity, and the hyperons are fermions with spin $\frac{1}{2}$. The description of the K^0 in terms of the Pais–Gell-Mann picture is in accord with experimental observations, and there is evidence that there exist attractive Λ^0- and Σ^+-nucleon forces. (D.E.B.)

1609

K-INTERACTIONS IN DEUTERIUM. R. D. Tripp (Univ. of California, Berkeley). pp. 184-6 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

The Berkeley Bevatron and a 15-in. deuterium bubble chamber were used in obtaining 1500 K^--d interactions. A preliminary analysis of 274 of these interactions is presented, showing final state and number observed. (D.E.B.)

1610

STRANGE PARTICLE INTERACTIONS, THEORETICAL. R. H. Dalitz (Univ. of Chicago). pp. 187-201 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

Available theoretical information on strange particle interactions is discussed with respect to the determination of the relative parities and the coupling parameters between K particles and hyperons in various interactions. K particle and hyperon spins of 0 and $\frac{1}{2}$, respectively, are assumed; consistent with experimental data. Also considered is the possibility of symmetries between the various interactions, for example, whether the hypothesis of a universal pion-baryon coupling proposed by Gell-Mann and by Schwinger is in accord with available data. (D.E.B.)

1611

DISPERSION EQUATIONS. M. L. Goldberger (Princeton Univ., N. J.). pp. 207-11 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

The derivations of dispersion relations are summarized. Included in the summary are relations for pion production by photons and electrons, relations for gamma-proton scattering, relations for the vertex function and nucleon—nucleon scattering, integral equations arising in dispersion theory, and remarks on the structure of the pion—nucleon vertex. (D.E.B.)

1612

FORBIDDING OF π-β DECAY. R. P. Feynman (California Inst. of Tech., Pasadena). pp. 216-19 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

Some of the mass, spin, and coupling considerations which appear in theoretical descriptions of π-μ and π-e decay are reviewed. Assumptions which require experimental verification before further theoretical development is allowed are pointed out. (D.E.B.)

1613

EXPERIMENTS ON PARITY CONSERVATION IN STRONG INTERACTIONS. A. Roberts (Univ. of Rochester, N. Y.). pp. 221 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

Two experiments on parity conservation, one at Rochester using π^+ mesons and one at Liverpool using neutrons, are described. In the first an up-down asymmetry of $E = 0.014 \pm 0.037$ was found, giving a value of $F^2 \leq 2 \times 10^{-3}$. In the second a change of asymmetry $\Delta E = 0.6 + 3.2 \times 10^{-4}$ was found, giving a value of $F^2 \leq 3.6 \times 10^{-6}$. (D.E.B.)

1614

MASS REVERSAL AND COMPOUND MODEL OF ELEMENTARY PARTICLES. L. B. Okun' (Academy of Sciences, Moscow). pp. 223-8 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

The consequences that follow from the invariance of the Lagrangian of interacting elementary particles with respect to the transformation of mass reversal: $\psi \rightarrow \gamma_5 \psi \cdot m \rightarrow -m$ for each particle separately, are examined. In interactions which conserve parity owing to mass reversal invariance elementary particles cannot be created nor destroyed singly. Thus conservation of strangeness and conservation of parity are interrelated. (auth)

1615

PHENOMENOLOGICAL THEORY OF THE S-MATRIX AND T, C AND P INVARIANCE. J. Werle (Inst. for Nuclear Research, Warsaw). pp. 229 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

It is suggested that in the S-matrix formalism both elementary and composite particles can be described by local field operators which satisfy the usual field equations of motion and free field commutation relations, even in the case of non-local interactions. (D.E.B.)

1616

WEAK INTERACTIONS: LEPTONIC MODES, EXPERIMENTAL. M. Goldhaber (Brookhaven National Lab., Upton, N. Y.). pp. 233-45 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

An experiment is described, involving a measurement of the neutrino helicity, which led to a unique determination of the beta interactions. The neutrino helicity was measured by a method which shows the connection between the helicity of a gamma ray emitted opposite a neutrino of given helicity for the spin sequence $0- \rightarrow 1- \rightarrow 0+$. Eu^{152m} was used. Also discussed are recent experiments which measured the lifetime of the free neutron and confirmed axial vector coupling using He^6, Li^8, and Na^{24}. The information gained on beta decay from these experiments is summarized. (D.E.B.)

1617

WEAK INTERACTIONS: LEPTONIC MODES, THEORETICAL I. L. Michel (Univ. of Lille, France). pp. 251-5 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

The known leptonic decays and three modes of K decay are listed, and the history of theoretical descriptions of these decays is briefly summarized. Problems associated with neutrino coupling and the conservation laws of weak couplings are indicated. (D.E.B.)

1618

WEAK INTERACTIONS: LEPTONIC MODES, THEORETICAL II. M. Gell-Mann (California Inst. of Tech., Pasadena). pp. 256-7 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

It is suggested that an attempt be made to form in the weak vector part of an interaction, which is not strangeness changing, a quantity coupled to leptons which should be conserved like the electromagnetic density. An expression is proposed for this conserved quantity, and its application to a particular case is discussed. (D.E.B.)

1619

NORMAL DECAY OF THE π MESON, THEORETICAL III. M. L. Goldberger and S. B. Treiman (Univ. of Princeton, N. J.). pp. 259-62 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

The normal decay $\pi \rightarrow \mu + \nu$ was studied to determine if the lifetime can be accounted for by ordinary β-interactions and pion-nucleon interactions. A qualitative calculation using dispersion methods was attempted and is described. (D.E.B.)

1620

WEAK INTERACTIONS: OTHER MODES, EXPERIMENTAL RESULTS. D. A. Glaser (Univ. of Michigan, Ann Arbor). pp. 265-9 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

Available experimental data on the following are summarized: lifetimes of Λ^0, Σ^+, Σ^-, θ_1^0, θ_2^0, K^-; decay branching ratios of Λ^0 and θ^0; spins of Λ^0, Σ^-, and θ^0; parity violating asymmetries in the decay of Λ^0, Σ^+, and Σ^-; Σ^0 mass determination; the $\theta_1 - \theta_2$ problem; and properties of artificially produced Ξ hyperons. (D.E.B.)

1621

TABLES OF Λ, K^0, $\Sigma^\pm$ LIFETIMES AND Λ^0, K^0 DECAY BRANCHING RATIOS. D. A. Glaser, M. L. Good, and D. R. O. Morrison. pp. 270-3 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

The tabulated results are given as mean values of experimental determinations from a number of sources. The values used in deriving each mean, the experimental technique used, and the experimental installation are included. (D.E.B.)

1622

WEAK INTERACTIONS: NON-LEPTONIC PROCESSES, THEORETICAL. S. B. Treiman (Princeton Univ., N. J.). pp. 276-82 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

Various theoretical attempts to describe non-leptonic weak interactions are discussed. The violation of parity and charge conjugation invariance in all known weak interactions led to the idea of a universal, parity non-conserving, V-A Fermi interaction. Weak-interaction models constructed along this line and the significance of spin conservation violation, the $K_1^0 - K_2^0$ complex, and parity non-conservation in Λ decay are described. (D.E.B.)

1623

Ke_3 AND $K\mu_3$ DECAYS AND RELATED SUBJECTS. R. E. Marshak (Univ. of Rochester, N. Y.). pp. 283-6 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

Equations are developed for describing Ke_3 and $K\mu_3$ decays, assuming the $I = \frac{1}{2}$ rule for the strangeness-non-conserving baryon current. Recent developments in studies of Λ^0 decay are included. (D.E.B.)

1624

THE INFLUENCE OF THE MEDIUM ON BREMSSTRAHLUNG IN HIGH-ENERGY ELECTRON-PHOTON SHOWERS. A. A. Varfolomeev, R. I. Gerasimova, I. L. Gurevich, et al. (Academy of Sciences, Moscow). pp. 297-302 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

Landau and Pomeranchuk have shown that bremsstrahlung is disturbed by multiple scattering as high-energy electrons go through a condensed medium. Ter-Mikarlyon has shown that polarization of the medium leads to an additional weakening of the soft part of the bremsstrahlung. An experimental study of these effects was made using emulsion stacks in high-energy cosmic radiation cascades. The bremsstrahlung spectra from exposures to electrons of energies between 10^{11} and 10^{12} ev are given. (D.E.B.)

1625

POLARIZATION IN p-n AND n-p SMALL ANGLE SCATTERING AT ABOUT 600 Mev. V. P. Dzhelepov, B. M. Golovin, Yu. V. Katyschev, et al. (Joint Inst. for Nuclear Research, Dubna). pp. 303-6 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

Nucleon-nucleon scattering experimental techniques and methods for interpreting their results are briefly discussed. Results are given from experimental studies of polarization as a function of scattering angle in n-p scattering at 95, 315, and 635 Mev; polarization cross section as a function of scattering angle; and polarization cross section as a function of neutron energy. (D.E.B.)

1626

EXPERIMENTS ON DOUBLE SCATTERING OF PROTONS AT HIGH ENERGY. N. E. Booth, F. L. Hereford, M. Huq, et al. (Univ. of Birmingham, Eng.). pp. 307-8 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

Two experiments are described and their results are given. In the first, the relative intensities of protons scattered near the vertical and near the horizontal planes at the second event of a double scattering process was studied. Protons of 980 Mev were scattered first from carbon at 4° and then from either carbon or polyethylene at 14°. The ratio of horizontal to vertical scattering was 0.940 ± 0.056. The second experiment was concerned with the polarization of protons scattered from carbon at 700 and 950 Mev. A plot of right-left asymmetry in double scattering is given. (D.E.B.)

1627

INTERACTION OF ~9 GeV PROTONS WITH NUCLEONS AND PHOTO-EMULSION NUCLEI. V. Beliakov, B. Bannik, N. Bogachev, et al. (Joint Inst. for Nuclear Research, Dubna). pp. 309-18 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

An emulsion stack, containing 100 pellicles of NIKF1-R emulsion of 450 μ thickness and 10 × 10 cm surface, was exposed in the Synchrophasotron to the inner proton beam accelerated to 8.7 Bev. Investigations were made of proton interactions with free and bound light and heavy nuclei, of proton—proton interaction mechanisms, of π^0 and strange particle generation, and of proton diffraction scattering by light nuclei. Results are given in graphs and tables. (D.E.B.)

1628

ANALYSIS OF NUCLEAR INTERACTIONS OF ENERGIES BETWEEN 10 AND 1000 GeV. E. Fenyves, E. Gombosi, and P. Suranyi (Central Research Inst. for Physics, Budapest). pp. 319-20 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

The angular and energy distribution of shower particles of seven nuclear interactions, mostly complex collisions, were measured. The Lorentz factor γ_{cm} of the center of mass system (cms) was determined from the energy of secondaries and the Lorentz factor γ_{sym} of the symmetry system was obtained from the angular distribution. It was found that $(\gamma_{sym}/\gamma_{cm}) = 0.92 \pm 0.15$ which corresponds to a symmetrical emission of shower particles in the cms. Energy distribution in the cms as well as transversal momentum distribution of shower particles were also determined. (auth)

1629

EVALUATION OF γ_0' FROM THE ANGULAR DISTRIBUTION OF JET PARTICLES IN LS USING CERTAIN SUPPOSITIONS ABOUT THEIR ANGULAR DISTRIBUTION IN THE C.M.S. V. Petržílka (Czechoslovak Academy of Sciences). pp. 321-2 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

A possible method for determining the energy of the primary particle in a nucleon—nucleon collision is described. The method is based on the angular distribution of particles in a jet by the expression F (u) where $u = \gamma_0' \theta$. γ_0' represents the primary energy of one nucleon in rest mass units, θ is the angle of emission of a shower particle in the laboratory system. The results of three applications of the equation are given. (D.E.B.)

1630

$\pi^- + p \rightarrow \Lambda^0 + \theta^0$; $\Lambda^0 \rightarrow p + \pi^-$ ANGULAR DISTRIBUTION OF PRODUCTION AND DECAY AT 1.12 GeV/c. F. S. Crawford, Jr., M. Cresti, M. L. Good, et al. (Univ. of California, Berkeley). pp. 323-7 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

At 1.12 Bev/c, 236 Λ^0 decays arising from $\pi^- + p \rightarrow \Lambda^0 + \theta^0$ were studied. The data from these events were processed and fitted to a production angular distribution curve, using s- and p- waves. The s- and p- wave analysis is summarized. (D.E.B.)

1631

A RE-ANALYSIS OF THE EXPERIMENTAL DATA ON HYPERNUCLEI DECAYING BY π^- EMISSION. R. Levi-Setti, W. E. Slater, and V. L. Telegdi (Univ. of Chicago). pp. 328 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

New experimental data are tabulated and compared with the 1957 Rochester Conference data. Differences are due to new events, recomputations, and the adoption of a new Q-value. (D.E.B.)

1632

HYPERON-NUCLEON INTERACTIONS. H. Weitzner (Harvard Univ., Cambridge, Mass.). pp. 329-31 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

For an examination of hyperfragment binding energies, a phenomenological potential was constructed. The form of the potential and the approximate ranges were obtained from the lowest order nonvanishing static potential produced in a Λ-N interaction and the standard N-π interaction. The interaction potential used in the variational calculation of the binding energies is given and discussed. (D.E.B.)

1633

SEARCH FOR ELECTRIC DIPOLE MOMENT OF THE MUON. D. Berley, R. L. Garwin, G. Gidal, and L. M. Lederman (Columbia Univ., New York). pp. 332 in "1958 Annual International Conference on High Energy Physics at CERN." Geneva, CERN, Scientific Information Service, 1958. 364p.

By experimentally measuring the precision of the muon spin vector in a cyclotron field, a value of f = 0.03 ± 0.011 was obtained for the muon electric dipole moment. (D.E.B.)

Heat Transfer and Fluid Flow

1634 AECU-3843

California. Univ., Los Angeles. Dept. of Engineering. HEAT TRANSFER TO A BOILING LIQUID; MECHANISM AND CORRELATIONS. Progress Report No. 7 (58-40). Kurt Forster and Ralph Greif. May 27, 1958. 42p. Contract AT(11-1)-34, Project 34. \$7.80(ph OTS); \$3.30(mf OTS).

Various heat transfer mechanisms which have been previously proposed are analyzed in the light of recent experiments. Evidence is presented in favor of a liquid-vapor exchange mechanism and against the widely accepted "micro-convection" mechanism. The vapor-liquid exchange mechanism is shown to explain the insensitivity of boiling heat flux to the level of subcooling. A "Reynolds Analogy" for nucleate boiling is presented in some detail. A procedure is given for calculating the superheat at which the liquid bulk velocity ceases to contribute to the heat flux. An expression for the growth of a vapor bubble in a highly superheated liquid is deduced. A method is presented which allows the deduction of correlations for nucleate boiling which give the dependence of heat flux on superheat and system pressure. Two such correlations are presented and results are compared with experiment. It is shown that one correlation yields the heat flux for different liquids varying from water to mercury, without necessitating any change in constant or exponent of the correlation. (auth)

1635 AERE-R/R-2645
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
VALVE STEM COOLING. G. B. Bishop. July 1958. 33p.

A theoretical analysis of heat flow and temperature distribution along valve stems is presented. Valve stems with fins and with no fins are considered. A theoretical treatment for forced-air cooling is presented, and some experimental work to verify the analysis is outlined. (J.R.D.)

1636 CEA-703
France. Commissariat à l'Énergie Atomique, Paris.
INSTALLATION D'ÉTUDE DE TRANSMISSION DE CHALEUR A DENSITÉ DE FLUX ELEVEE. (Installation for the Study of Heat Transfer with High Flux Density.) M. Robin and B. Schwab. 1957. 23p.

A description is given of an installation used for the study of heat transfer with high flux density, which uses liquid metals and alloys as the heat exchanger. The loop was tested with a Na–K alloy containing 56 wt. % K and a flux density of more than 200 w/cm^2 with the alloy at a temperature of 550°C. (J.S.R.)

1637 IDO-16486
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
TRANSFER FUNCTIONS OF HEAT EXCHANGERS AND HEAT EXCHANGE PROCESSES APPLICABLE TO NUCLEAR REACTORS. S. R. Gossmann. Oct. 9, 1958. 26p. Contract AT(10-1)-205. $0.75(OTS).

The transfer function of a heat exchanger commonly appearing in the literature is defined as the ratio of the outlet temperature of the secondary or demand side to the inlet temperature of the primary or supply side. In coupling a heat exchanger to a nuclear reactor core for reactivity feedback calculations, this transfer function is not applicable. Instead, what is needed is the ratio of the outlet to the inlet temperature of the same fluid—usually the primary. Such transfer functions for various models of heat exchangers have been derived. Also, two heat transfer processes are presented which may be used to describe the transient transfer of heat in a distributed reactor core. (auth)

1638 K-1402
Oak Ridge Gaseous Diffusion Plant, Tenn.
COUETTE FLOW AT INTERMEDIATE PRESSURES. Wendell C. DeMarcus. Nov. 19, 1958. 11p. Contract W-7405-eng-26. $0.50(OTS).

A mean free path treatment is used to study Couette flow at pressures ranging from a perfect vacuum to normal laboratory gas pressures. (auth)

1639 K-1403
Oak Ridge Gaseous Diffusion Plant, Tenn.
EFFECT OF TEMPERATURE GRADIENTS ON GAS AND HEAT TRANSPORT IN POROUS MEDIA. Edwin N. Lassettre. Nov. 18, 1958. 9p. Contract W-7405-eng-26. $0.50(OTS).

The influence of specular reflection on the permeability of a bed of spherical particles has been treated previously. In the present work the treatment is modified so as to take account of nonuniform temperatures. Mass and energy transport expressions are obtained, and the analog of the Wiedemann-Franz ratio is computed. (auth)

1640 KAPL-M-D1C-TD-3
Knolls Atomic Power Lab., Schenectady, N. Y.
TIGER: AN IBM-704 DIGITAL COMPUTER PROGRAM —TEMPERATURES FROM INTERNAL GENERATION RATES. A. P. Bray. Sept. 30, 1958. 57p. Contract W-31-109-Eng-52. $9.30(ph OTS); $3.60(mf OTS).

An IBM-704 digital computer program was developed. This program, called TIGER, is capable of determining transient as well as steady-state temperature distributions in a three dimensional field containing internal heat generation. Both the internal heat generation and boundary temperatures may be varied in time in either a step or ramp function. A complete description of the digital computer program and a sample investigation employing this program are presented. (auth)

1641 KAPL-M-GOM-2
Knolls Atomic Power Lab., Schenectady, N. Y.
A REVIEW AND ASSESSMENT OF BOILING HEAT TRANSFER AND THE DEPARTURE FROM NUCLEATE BOILING. Gerhard O. Mueller. Aug. 19, 1958. 98p. Contract W-31-109-Eng-52. $15.30(ph OTS); $5.40 (mf OTS).

A review and assessment of current status of boiling heat transfer and DNB (departure from nucleate boiling, formerly burnout) covering theories, procedures, and existing correlations were made. Discussion of the basic theories of nucleation and DNB, the factors which influence boiling, an evaluation of the experimental procedures and a comparison of the correlations presently being used in the field of nuclear reactor and power plant design are included. A table of previous boiling heat transfer and DNB data is included in the appendix. (auth)

1642 NACA-TN-4349
Langley Aeronautical Lab., Langley Field, Va.
HEAT TRANSFER AND THERMAL STRESSES IN SANDWICH PANELS. Robert T. Swann. Sept. 1958. 34p.

Calculated maximum temperature differences between faces and calculated thermal stresses are presented for sandwich panels with a prescribed linear rate of temperature rise at one face and with the other face insulated. Effects of conduction and radiation are included. Maximum temperature differences between top and bottom faces are considerably less when both radiation and conduction are considered than when radiation is neglected. From the calculated data an equation is derived that relates the maximum temperature difference to the maximum temperature difference when conduction only is considered. An approximate method for including effects of radiation in calculations of temperature difference is presented. (auth)

1643 NACA-TN-4369
Lewis Flight Propulsion Lab., Cleveland.
SLIP-FLOW HEAT TRANSFER FROM CYLINDERS IN SUBSONIC AIRSTREAMS. Lionel V. Baldwin. Sept. 1958. 79p.

Heat-transfer coefficients for normal cylinders in air were measured for Mach numbers 0.05 to 0.80, Reynolds numbers 1 to 75, and Knudsen numbers 0.009 to 0.077 at air temperatures from 0 to 280°F and wire temperatures from 34 to 620°F. The measured Nusselt numbers in this slip-flow experiment were extrapolated with good agreement to existing continuum-flow empirical relations at low Kn. The data qualitatively verified predictions of free-molecular flow theory at high Kn. The heat-transfer coefficient increased with increasing wire temperature at $Kn < 0.02$; at $Kn > 0.02$, this effect reversed. Over 1000 data points are tabulated, and application of the results to hot-wire anemometry is discussed. (auth)

1644 AEC-tr-3405
PROBLEMS OF HEAT TRANSFER DURING A CHANGE OF STATE: A COLLECTION OF ARTICLES. (Voprosy Teploobmena pri Izmenenii Agragatnogo Sostoyaniya Veshchestva: Sbornik Statei). S. S. Kutateladze. Translated from a publication of the State Power Press, Moscow—Leningrad, 1953. 193p. $2.50(OTS).

The first group of papers in the symposium deals with problems of heat transfer in the condensers of steam prime movers and refrigeration machinery. The second group of papers reports experimental data on the output of heat during boiling, especially in high-intensity processes. The last two papers are devoted to the rates of accumulation and melting of ice as functions of the conditions of heat transfer between the solid and liquid phases. (W.L.H.)

1645
THE EFFECT OF FLOW PERTURBATIONS AT THE INLET ON THE HEAT TRANSFER IN LIQUIDS IN TUBES AND RING SLOTS. Günther Grass. Atomkern-Energie 3, 382-8(1958) Oct. (In German)

Heat transfer results are presented for the flow of water in the entrance length of a 1500 mm long tube with 10 to 12 mm diameter. The tests were carried out with constant heat input per unit length. The tested tube entrances were preceded by a hydrodynamic calming section or by orifices with different diameters. Heat transfer in the entrance length was found to be 1.5 to 17 times greater than at the end of tube. The resulting entrance lengths were from 10 to 15 tube diameters over the Reynolds humber range of 5000 to 30,000. By analytical study it was possible to summarize the results in the form of working formula which was in excellent agreement with the tests. (auth)

1646
NUCLEAR BOILING. A CORRELATION. Charles H. Gilmour (Union Carbide Chemicals Co., South Charleston, W. Va.). Chem. Eng. Progr. 54, No. 10, 77-9(1958) Oct.

An expression for nucleate boiling which resembles those for sensible heat transfer and condensing, based on a new correlation of existing data, is presented. Argument and substantiation of the correlation are included, along with graphs and equations. (J.R.D.)

1647
HEAT TRANSFER COEFFICIENTS OBSERVED IN SMALL SODIUM EXCHANGERS. Seymour C. Hyman (Nuclear Development Corp. of America, White Plains, N. Y.). Chem. Eng. Progr. 54, No. 10, 81-2(1958) Oct.

Results of heat transfer coefficients which lend support to an empirical procedure that may be useful to designers with problems that cannot wait for full understanding of the problem are presented. Equations based on observation for calculation of over-all heat transfer coefficients for tube and annular exchangers are also presented. (J.R.D.)

1648
DESCRIPTION AND EXPERIMENTAL RESULTS OF TWO REGENERATIVE HEAT EXCHANGERS. E. K. Dabora, M. P. Moyle, R. Phillips, J. A. Nicholls, and P. L. Jackson (Univ. of Michigan, Ann Arbor). Chem. Eng. Progr. 54, No. 10, 86-7(1958) Oct.

Two pebble-type regenerative heat exchangers capable of operating at pressures and temperatures beyond the limits of commercially available equipment were constructed. The heat loss from these exchangers was investigated, and a theoretical analysis was developed to include the loss. It is pointed out that careful evaluation of this product is essential for predicting the steady-state temperature at the exit of this type of exchanger. (J.R.D.)

1649
HEAT TRANSFER AND PRESSURE DROP OF AIR IN FORCED CONVECTION ACROSS TRIANGULAR-PITCH BANKS OF FINNED TUBES. Dennis J. Ward and Edwin H. Young (Univ. of Michigan, Ann Arbor). Chem. Eng. Progr. 54, No. 10, 87-8(1958) Oct.

The effects of tube geometry on the heat transfer and pressure drop characteristics of triangular-pitch tube banks containing smooth, integral, helically finned tubes with air drawn by forced convection in cross flow through the banks were investigated. Heat transfer data are correlated and presented graphically. (J.R.D.)

1650
HEAT TRANSFER RATES TO BOILING FREON 114 IN VERTICAL COPPER TUBES. H. L. Foltz and R. G. Murray (Goodyear Atomic Corp., Portsmouth, Ohio). Chem. Eng. Progr. 54, No. 10, 88-9(1958) Oct.

Heat transfer rates from condensing steam to boiling Freon 114 were measured in vertical copper tubes. The rates were uniform along the length of the tube up to a temperature differential of 20°F. Above this temperature difference, 12.5% of the area transferred up to 75% of the total heat. (J.R.D.)

1651
CONDENSING HEAT TRANSFER WITHIN HORIZONTAL TUBES. W. W. Akers (Rice Inst., Houston, Texas), H. A. Deans (Princeton Univ., N. J.), and O. K. Crosser (Univ. of Oklahoma, Norman). Chem. Eng. Progr. 54, No. 10, 89-90(1958) Oct.

The effects of vapor velocity, liquid loading, and physical properties of the fluid on the condensing coefficient of a vapor in a horizontal tube were investigated. The data, presented in graphs, were obtained in tests in which the average condensing coefficient was determined as a function of the mass flow of the vapor in the tube at constant tube wall temperature and constant pressure. (J.R.D.)

1652
THERMAL TRANSFER IN TURBULENT GAS STREAMS. EFFECT OF TURBULENCE ON MACROSCOPIC TRANSPORT FROM SPHERES. Kazuhiko Sato and B. H. Sage (California Inst. of Tech., Pasadena). Trans. Am. Soc. Mech. Engrs. 80, 1380-8(1958) Oct.

The rate of thermal transport from spheres in a flowing stream is of interest in many industrial operations. Limited data are available concerning the effect of turbulence level on this transfer process. Measurements of the thermal transport from spheres to an air stream at four levels of turbulence were made at four velocities varying between 4 and 32 fps. Results are presented in terms of the Nusselt number. The experimental work is a portion of a detailed study of the local thermal and material transport from spheres in turbulent air streams. The data indicate a significant increase in the thermal transport with an increase in the level of turbulence at a constant Reynolds number. For example, the Nusselt number was increased from 53 to 62 upon an increase in the level of turbulence from 0.05 to 0.12 at a Reynolds number of 7200. (auth)

1653

BOILING HEAT TRANSFER TO WATER CONTAINING A VOLATILE ADDITIVE. G. Leppert, C. P. Costello (Stanford Univ., Calif.), and B. M. Hoglund (Argonne National Lab., Lemont, Ill.). Trans. Am. Soc. Mech. Engrs. 80, 1395-1404(1958) Oct.

Aspects of local boiling in forced circulation when the boiling fluid contains small percentages of alcohol are discussed. Particular emphasis is placed on the improvement in smoothness of boiling and in the decrease of average bubble size when the additive is present, as contrasted with boiling distilled water. Experimental results, including photographs, are presented for surface boiling from the outside of a cylindrical stainless-steel tube placed normal to the flow. Data are also presented for the subcooled boiling of distilled water, and comparisons are made with correlations from the literature. (auth)

1654

AN INVESTIGATION OF EFFECTIVE THERMAL CONDUCTIVITIES OF POWDERS IN VARIOUS GASES. R. G. Deissler and J. S. Boegli (Lewis Flight Propulsion Lab., Cleveland). Trans. Am. Soc. Mech. Engrs. 80, 1417-25(1958) Oct.

An experimental study was made to determine the effective thermal conductivities of magnesium oxide, stainless steel, and uranium oxide powders in various gases. The gases included air, helium, argon, nitrogen, neon, and various mixtures of these gases. The variables investigated included temperature level, gas pressure, porosity, gas conductivity, and solid conductivity. A reasonably good correlation of the data was obtained by using the dimensionless groups effective thermal conductivity over gas conductivity, solid conductivity over gas conductivity, and porosity of the powder, although the effective conductivity may also be a function of the shape and arrangement of the particles. A solution for spheres in cubical array was obtained by relaxation and was in reasonable agreement with the data for porosities in the neighborhood of that for the spheres. (auth)

1655

LOCAL LAMINAR HEAT TRANSFER IN WEDGE-SHAPED PASSAGES. E. R. G. Eckert, T. F. Irvine, Jr., and J. T. Yen (Univ. of Minnesota, Minneapolis). Trans. Am. Soc. Mech. Engrs. 80, 1433-8(1958) Oct.

Heat transfer in noncircular passages recently has received increased attention in connection with various engineering applications, especially with nuclear-reactor technology. The present paper presents the results of calculations for heat transfer connected with steady laminar flow through ducts whose cross sections have the shape of circular sectors. Hydraulically and thermally developed flow is assumed. The temperature field peripheral distribution of inner-transfer coefficients and friction factors are presented for two boundary conditions: Peripherally constant heat flux and peripherally constant surface temperature, both with longitudinally constant heat flux. It is found that even average heat-transfer coefficients may be different by an order of magnitude for these two conditions. For this reason, it is pointed out that solutions for a class of boundary conditions can be obtained by linear superposition of the results obtained for the two conditions mentioned. (auth)

1656

ONE-DIMENSIONAL MOTION IN MAGNETOHYDRODYNAMICS. G. S. Golitsyn (Inst. of Atmospheric Physics, Academy of Sciences, USSR). Zhur. Ekspt'l. i Teoret. Fiz. 35, 776-81(1958). (In Russian)

The motion of a perfect conducting gas in a magnetic field is investigated. The Riemann invariants for a number of gases are computed and some nonstationary problems are solved. A new method is proposed for determination of the approximate general solution of the magnetohydrodynamic equations. Some types of motion in the presence of shock waves are considered. (tr-auth)

Nuclear Properties and Reactions

1657 AECU-3767

Los Alamos Scientific Lab., N. Mex.

ELASTIC SCATTERING OF PROTONS AND NEUTRONS BY DEUTERONS. R. L. Bivins, R. M. Frank, and J. L. Gammel. [1955?]. 38p. Contract [W-7405-eng-36]. $6.30(ph OTS); $3.00(mf OTS).

It is shown how a momentum space formulation of the p-d and n-d scattering problem makes possible a good calculation of the no-polarization approximation. Calculations are carried out for a central Yukawa shaped Serber potential for values of the angular momentum $l = 0$ to 6 in the energy range 0 to 95 Mev. These show that Born's approximation is not a good approximation at any energy, even for $l = 3$. It is shown that a Fredholm approximation reproduces the results of the no polarization approximation for $l \geq 1$. The results are compared with those of Christian and Gammel and the experimental data. (auth)

1658 AERE-R/R-2687

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

CROSS-SECTIONS AT VARIOUS DISTANCES IN WATER FOR SEVERAL FAST NEUTRON DETECTORS. R. N. Glover and K. Maddocks. Sept. 1958. 9p. $0.25(OTS).

Cross-sections were calculated for several threshold detectors at distances of 0 to 90 cms from a point fission source in water by numerical integration using theoretical spectra derived by Aronson et al. and cross section data from BNL 325 and recently published papers. These cross-sections have successfully interpreted fast neutron measurements in the LIDO 'Panel C' facility. (auth)

1659 GMR-116

General Motors Corp. Research Staff, Detroit.

INELASTIC TRANSFER CROSS-SECTIONS FOR GNU MULTIGROUP CODE. Arthur A. Vuylsteke. Sept. 27, 1957. 18p.

The calculation of inelastic, group-transfer cross sections for use with the IBM-704 GNU code is described. Among the materials for which cross sections were calculated are Cr, Fe, Ni, U^{235}, and U^{238}. (D.E.B.)

1660 NP-7006
Weizmann Inst. of Science, Rehovoth, Israel.
ENERGIES OF GROUND AND EXCITED NUCLEAR CONFIGURATIONS IN THE $op_{1/2}$ REGION. I. Unna and I. Talmi. 1957. 29p. Contract AF61(052)-56.

Shell model analysis is applied to configurations containing both $p_{1/2}$ and $s_{1/2}$ nucleons. Energy levels of excited configurations (often recognized by their parity being opposite to that of the ground state) as well as binding energies are considered. Good agreement is obtained which gives support to the jj-coupling scheme. The results obtained are used for calculating other levels. In particular, the modes of excitation of the first excited o^+ level in O^{16} and the ½-level in F^{19} are determined. (auth)

1661 ORNL-2127(Pt. II(Vol. 3))
Oak Ridge National Lab., Tenn.
URANIUM-235 FISSION-PRODUCT PRODUCTION AS A FUNCTION OF THERMAL NEUTRON FLUX, IRRADIATION TIME, AND DECAY TIME. II. SUMMATIONS OF INDIVIDUAL CHAINS, ELEMENTS, AND THE RARE-GAS AND RARE-EARTH GROUPS. J. O. Blomeke and Mary F. Todd. Nov. 3, 1958. 361p. Contract W-7405-eng-26. $5.00(OTS).

Levels of fission products resulting from thermal fission of U^{235} in reactor fuels were compared over a wide range of reactor operating conditions and decay times. Values of approximately 300 fission products are presented in graphical form together with gross totals of their activities, radiation powers, and thermal neutron poisoning. The gamma spectrum is further broken into four groups of specified energy ranges, which are suitable for use in shielding design. Tabulation of these properties is arranged as to chain or mass number, element, and as to the rare-gas and rare-earth groups. (A.C.)

1662 UCRL-3628
California. Univ., Berkeley. Radiation Lab.
EXCITATION FUNCTIONS FOR REACTIONS OF BEV PROTONS ON INDIUM (thesis). David R. Nethaway. Jan. 1957. 26p. Contract W-7405-eng-48. $4.80(ph OTS); $2.70(mf OTS).

Indium was bombarded with protons in the energy range 2 to 6 Bev. Cross sections are reported for the $(p,p\pi^+)$, (p,pn), and (p,p′) reactions, as well as those for the formation of Be^7 and several neutron deficient isotopes of cadmium and indium. It was found that the (p,pn) yield increases slowly in the energy range 2 to 6 Bev, while the $(p,p\pi^+)$ and (p,p′) yields are approximately constant. The variation of the (p,pn) and $(p,p\pi^+)$ yields with target thickness is discussed. The yields of several isomeric levels are correlated with their nuclear spin. (auth)

1663 UCRL-8423
California. Univ., Berkeley. Radiation Lab.
NUCLEAR DECAY STUDIES OF PROTACTINIUM ISOTOPES (thesis). Max W. Hill. Aug. 1958. 108p. Contract W-7405-eng-48. $2.50(OTS).

A study was made of the radiations of the protactinium isotopes Pa^{227}, Pa^{228}, Pa^{229}, Pa^{230}, Pa^{232}, and Pa^{233}, as well as Ac^{223} and Ac^{224}, with primary emphasis placed on the investigation of the alpha-decay spectra with high-resolution alpha-particle spectrographs. Decay schemes are presented in each case, and are interpreted wherever possible in terms of current theoretical nuclear models. The collective model of Bohr and Mottelson finds wide application in most cases, although the complexity of the decay schemes leaves certain features unexplained. (auth)

1664 AEC-tr-3444
THE RATE OF MIGRATION OF PROTONS IN THE ELECTRIC FIELD IN THE ALPHA PHASE OF THE PALLADIUM-HYDROGEN SYSTEM. Carl Wagner and Gerhard Heller. Translated by S. E. Piel (Westinghouse Electric Corp. Bettis Atomic Power Div.) from Z. physik. Chem.(Leipzig) 46B, 242-9 (1940). 9p.

The transference number of hydrogen in Pd(α phase equilibrium with H_2 gas at 1 atm pressure) was established as 0.79×10^{-6} at 182°C and 1.19×10^{-6} at 240°C. From this are calculated rates of proton migrations of 1.46×10^{-4} or 2.80×10^{-4} $cm^2 \times volt^{-1} sec^{-1}$. These figures are ~0.4 to 0.55 times smaller than the values that are calculated from the rate of diffusion. The difference can be explained qualitatively through the shielding of the proton charge through electrons as well as through electron phoresis (electron friction). (auth)

1665
ON THE DECAY OF Bi^{204}. R. Stockendal, T. Novakov, B. Johansson, and M. Schmorak (Nobel Inst. of Physics, Stockholm). Arkiv Fysik 14, 65-84(1958).

Energy levels in Pb^{204} were studied in the electron capture decay of 12 hr Bi^{204}. 45 transitions and about 20 weak unassigned conversion lines were found. Energies and intensities of conversion lines were measured in permanent magnet and double-focusing spectrometers. Relative gamma intensities were obtained by use of a scintillation spectrometer. Electron-gamma and gamma-gamma coincidence measurements were performed with instruments including a 100-channel pulse-height analyzer. A tentative decay scheme is discussed. (auth)

1666
ON THE DECAY OF Bi^{203}. T. Novakov, R. Stockendal, M. Schmorak, and B. Johansson (Nobel Inst. of Physics, Stockholm). Arkiv Fysik 14, 85-99(1958).

The level scheme of Pb^{203} was studied in the decay of 12 hr Bi^{203}. The experiments included energy and intensity measurements on conversion lines in permanent magnet and double-focusing spectrometers, measurements of relative gamma intensities in a scintillation spectrometer, electron-gamma and gamma-gamma coincidence measurements using a 100-channel pulse-height analyzer. Positrons were discovered from studies in an intermediate image beta-spectrometer, and in a double-focusing spectrometer the positron emission was resolved in two components, 740 ± 50 and 1350 ± 50 kev. A decay scheme is suggested. (auth)

1667
3.20 Mev γ-RADIATION OF ThD DETERMINED BY THE PHOTOGRAPHIC EMULSION TECHNIQUE. H. Niewodniczanski and M. Wielowiejska (Jagellonian Univ., Krakow). Bull. acad. polon. sci. Classe 3 1, No. 7, 293-6(1953).

The gamma spectrum of a mesothorium sample above 1.67 Mev was studied by an emulsion technique. The gamma photon energy was determined from proton recoil lengths in plates irradiated by photoneutrons produced in Be. Energies of 2.67 and 3.19 Mev were found in a ratio of about 10 to 1. (T.R.H.)

1668

ANGULAR DISTRIBUTION OF PHOTO-NEUTRONS FROM BERYLLIUM. H. Niewodniczanski and M. Wielowiejska (Jagellonian Univ., Krakow). Bull. acad. polon. sci. Classe 3 2, No. 1, 25-9(1954).

The angular distribution of photoneutrons from Be was studied by proton track counting in emulsion plates. The photoneutrons were produced by gamma photons from ThD(Pb^{208}). For 2.62 Mev gammas an a/b ratio of 1.56 ± 0.11 was found and at 3.20 Mev, 1.26 ± 0.16. (T.R.H.)

1669

STUDY OF Ir^{191m}. J. A. R. Cloutier and A. Henrikson (McGill Univ., Montreal). Can. J. Phys. 36, 1253-60 (1958) Oct.

Using the McGill 100-Mev proton synchro-cyclotron, the half life of Ir^{191m} was redetermined and the value 4.53 ± 0.18 s obtained from 55 trials. The mass assignment is here based on the study of the excitation curves for both osmium and iridium targets. The measured $\alpha_k = 2.0 \pm 0.3$ for the observed 126 ± 6 kev gamma ray is consistent with the M1 + E2 assignment previously made. No 42-kev gamma ray could be detected. (auth)

1670

NOTE ON THE SINGLE-PARTICLE ENERGY AND THE BINDING ENERGY OF MANY-BODY, SATURATED SYSTEMS. George A. Baker, Jr. (Los Alamos Scientific Lab., N. Mex.). Can. J. Phys. 36, 1261-4(1958) Oct.

Brueckner recently pointed out that, for saturation, $(E_{av} - E(p_F))$ does not vanish in general because of "important many-body contributions to the single particle energy which arise from the effects of the exclusion principle and from the variation of the self-consistent excitation spectrum with density." This difference is evaluated in terms of the properties of the single-particle potential. (auth)

1671

ACTIVATION CROSS SECTIONS FOR $C^{12}(p,pn)C^{11}$, $O^{16}(p,\alpha)N^{13}$, AND $F^{19}(p,pn)F^{18}$. A. B. Whitehead and J. S. Foster (McGill Univ., Montreal). Can. J. Phys. 36, 1276-85(1958) Oct.

The activation cross sections for proton-induced nuclear reactions were studied in the region from threshold over a range of about 10 Mev proton energy. The scattering and 180°-focussing technique for proton irradiation was employed to realize improved energy resolution. The reaction $O^{16}(p,\alpha)N^{13}$ exhibited three large peaks at proton energies of 8.6, 11.3, and 14.6 Mev in the laboratory system. The maximum cross sections were 46, 55, and 45 mb respectively. Though not so pronounced as in the oxygen case, minor peaks in the cross section for $C^{12}(p,pn)C^{11} + C^{12}(p,d)C^{11}$ modulated the previously smooth curve. These occurred at energies of 19.8, 20.9, and 22.2 Mev. The known excitation function for this reaction was extended from 32 to 42 Mev and proved to be flat, thereby clarifying the normalization between the higher- and lower-energy regions. The irradiation of F^{19} with protons to produce F^{18} yielded a cross section which was a smooth function of energy, and thus differed in shape from the corresponding carbon curve. (auth)

1672

CALCULATION OF FREQUENCIES AND RELATIVE INTENSITIES OF NUCLEAR SPIN RESONANCE LINES IN CRYSTALS. M. Bloom, L. B. Robinson, and G. M. Volkoff (Univ. of British Columbia, Vancouver). Can. J. Phys. 36, 1286-94(1958) Oct.

Previous calculations of the dependence on the strength of the external magnetic field H_0 of the energy levels and the expected frequencies of nuclear spin resonance lines of Al^{27} nuclei in a single crystal of $LiAl(SiO_3)_2$ (spodumene) were extended over a wide range of H_0 to more general orientations of the crystal with respect to H_0. In order to describe the variation with H_0 of the relative signal strength of a nuclear spin resonance line in a crystal, as observed with a crossed-coil spectrometer, a system of modified Bloch equations was set up which describe the behavior of the magnetization vector of a two-level system when transitions are induced by an oscillating magnetic field. Solutions of these equations are used to explain the difference in the dependence on H_0 of signal strengths in crossed-coil and in single-coil spectrometers. (auth)

1673

THE NUCLEAR SPIN RESONANCE SPECTRUM OF Al^{27} IN SPODUMENE. L. B. Robinson (Univ. of British Columbia, Vancouver). Can. J. Phys. 36, 1295-1307 (1958) Oct.

An experimental study was made of the nuclear spin resonance spectrum of Al^{27} in a single crystal of spodumene ($LiAl(SiO_3)_2$) over a range of external magnetic field H_0 wide enough ($0 \leq R \equiv 4\mu H_0/eQ\phi_{zz} < 2$) to bridge for the first time the gap between pure quadrupole interactions ($R \gg 1$). Experimental results on the resonance frequencies and relative signal amplitudes obtained with an induction type of nuclear resonance spectrometer are described, and are found to be in good agreement with the theoretical predictions given in the preceding companion paper. (auth)

1674

THE DECAY OF Os^{191} AND Os^{193}. S. V. Nablo, M. W. Johns, A. Artna, and R. H. Goodman (McMaster Univ., Hamilton, Ont., Can.). Can. J. Phys. 36, 1409-29 (1958) Oct.

The beta- and gamma-ray spectra of Os^{191} and Os^{193} were studied with a magnetic beta-ray spectrometer, scintillation spectrometers, and coincidence circuits. The 14-hour isomer of Os^{191} decays via a 0.0742-Mev (M3) transition. Gamma rays of energy 0.0418 (100%, E3), 0.0809 (1%, M1 + E2), 0.1287 (100%, M1 + E2), and 0.1858 (0.1%) Mev were found to be associated with the 14.6 ± 0.3 day decay of Os^{191} and an extension of the accepted decay scheme proposed. The following 19 transitions were associated with the 31.5 ± 0.5 hour decay of Os^{193}: 0.0730 (14%), 0.1068 (~ 1%), 0.1393 (10%), 0.180 (0.3%), 0.196 (0.1%), 0.243 (~ 0.2%), 0.2485 (0.3%), 0.2514 (0.4%), 0.278 (0.6%), 0.2810 (1.6%), 0.2885 (0.3%), 0.2994 (0.4%), 0.314 (0.3%), 0.3218 (1.7%), 0.3620 (0.6%), 0.3878 (1.6%), 0.4604 (4.1%), 0.4857 (0.3%), and 0.5585 (2.2%). The internal conversion coefficients for all the stronger transitions suggest that they are M1 + E2 in character. The decay energy of Os^{193} is 1.132 ± 0.005 Mev. Fermi analyses and beta-gamma coincidence experiments established excited states of Ir^{193} at 0.073, 0.139, 0.281, 0.362, 0.460, and 0.559 Mev above the ground state. Six otherwise unclassified weak gamma rays can be accommodated if levels at 0.247, 0.315, and 0.613 Mev are included in the decay scheme. The activation cross sections of Os^{184} and Os^{190} are $(2.2 \pm 0.5) \times 10^3$ and 5.3 ± 2 barns respectively, relative to Seren's value of 1.6 ± 0.4 barns for Os^{192}. (auth)

1675

ENERGY OF THE NUCLEAR GIANT RESONANCE. Michel Fabre de la Ripelle. Compt. rend. 247, 926-9 (1958) Sept. 29. (In French)

An attempt is made to clarify the questions on the reality of the collective model of Goldhaber and Teller which explains the position of the maximum of the nuclear giant resonance in the (γ,n) and (γ,p) reactions. (tr-auth)

1676

A UNIFIED FORMULATION OF THE THEORY OF NUCLEAR REACTIONS. Claude Bloch (Centre d'Etudes Nucleaires, Saclay, Gif-sur-Yvette, France). Nuclear Phys. 4, 503-28(1957).

The determination of the scattering matrix in the theory of nuclear reactions is essentially equivalent to the Green function for the Schroedinger equation in the internal region of the configuration space with proper boundary conditions at the nuclear surface. This Green function can be expressed as the inverse of an operator involving the sum of the Hamiltonian and of a boundary value operator which is different from zero only on the nuclear surface where it has a singularity of the same kind as a Dirac function. A general operator expression for the scattering matrix is derived. This expression can be transformed into a matrix expression by introducing an arbitrary basis of orthonormal functions in the internal region. The Wigner-Eisenbud and the Peierls-Kapur formulations are obtained by an appropriate choice of the internal functions. When a large number of resonances contribute to the cross-section, the expansion of the scattering matrix in terms of resonances of the compound system is not useful, and a more appropriate starting point can be obtained from a perturbation expansion of the scattering matrix which is easily derived from the general operator expression. A simple statistical assumption is proposed in order to determine the dominant terms in such an expansion. It leads to the optical model for the elastic scattering and to the direct interactions for the inelastic scattering. (auth)

1677

ROTATIONAL STATES IN EVEN ATOMIC NUCLEI. A. S. Davydov and G. F. Filippov (Moscow State Univ.). Nuclear Phys. 8, 237-49(1958) Oct. (1)

A theory of the energy states and the electromagnetic transitions between them is developed for nuclei which do not possess axial symmetry. It is shown that violation of axial symmetry does not significantly change the rotational states of axial nuclei and leads to the appearance of new energy states. The reduced probabilities for E2 and M1 transitions between various rotational states are computed. (auth)

1678

GAMMA-RAY SPECTRUM OF RADIUM IN EQUILIBRIUM WITH ITS DECAY PRODUCTS. B. S. Dzelepow and n. N. Zhukovsky (V. G. Khlopin Radium Inst., Academy of Sciences, Leningrad) and S. A. Shestopalova and I. F. Uchevatkin (D. I. Mendeleyev Research Inst. of Metrology, Leningrad). Nuclear Phys. 8, 250-64(1958) Oct. (1)

Results are described of an investigation of the radium gamma-spectrum in equilibrium with its decay products, based on recoil electron measurements in the energy range 150 to 2530 kev. Forty-four gamma-lines were observed, and their relative intensities and the number of quanta per disintegration determined. (auth)

1679

ON ANGULAR DISTRIBUTIONS IN COMPOUND NUCLEUS PROCESSES. T. Ericson (NORDITA, Copenhagen) and V. Strutinski (Universitetets Institut for Teoretisk Fysik, Copenhagen). Nuclear Phys. 8, 284-93(1958) Oct. (1)

The angular anisotropy of particles emitted in compound processes is due to restrictions on the directions of their angular momenta. These restrictions are imposed by the angular momentum distribution of the residual nucleus. The anisotropy is derived in a classical limit. (auth)

1680

CLASSIFICATION OF TRITON WAVE FUNCTIONS. G. Derrick and J. M. Blatt (Univ. of Sydney). Nuclear Phys. 8, 310-24(1958) Oct. (1)

A classification of all angular momentum-isobaric spin functions which can be present in the ground state wave function of H^3 is carried out by methods of group theory. This classification, based on the behavior of the functions under rotations of the co-ordinate axes and permutations of the three nucleons, yields three S-state functions, four P-state functions, and three D-state functions. All ten states are present in H^3 if noncentral forces exist between nucleons. (auth)

1681

OPTICAL MODEL INTERACTION BETWEEN MEDIUM ENERGY NEUTRONS AND NUCLEI. A. V. Lukyanov, Yu. V. Orlov, and V. V. Turovtsev (Scientific Research Inst. of Nuclear Physics, Moscow State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 750-6(1958). (In Russian)

An optical model is investigated in which the nucleus is described by a complex potential with a tail possessing the form of a third degree polynomial. Parameters of the model were found which yield the best agreement between the theoretical cross sections σ_t, σ_r, and σ_s with the experimental values for 14-Mev neutrons. For nuclei heavier than chromium the agreement is quite satisfactory. The angular distributions of elastically scattered neutrons computed on basis of the above mentioned parameter values are also in satisfactory agreement with experiment. A preliminary study of the region of smaller energies indicates that the parameters weakly depend on the energy over a comparatively broad range. (tr-auth)

1682

NUCLEAR BINDING ENERGIES ON THE STATISTICAL MODEL. N. V. Findler (Univ. of Sydney). Nuclear Phys. 8, 338-57(1958) Oct. (1)

An investigation was made of the binding energies of nuclei by means of the statistical theory. A static, charge independent, scalar meson potential is assumed, and high-energy nucleon-nucleon scattering results were used to limit the parameters occurring in the potential. The weight factors obtained for the particular exchange forces are entirely different from the usual values. The mass of the meson used in the theory is close to that of the π-meson. Also the obtained mesonic charge is reasonable. The binding energies and the nuclear radii are in satisfactory agreement with the known values from $A = 10$ on. However, for the very light nuclei, the calculated binding energy is too high. The angular distribution of the differential cross section for n—p scattering also shows the short-comings of our assumptions. (auth)

1683

EFFECTIVE RANGE EXPANSION OF THE SCATTERING MATRIX. L. M. Delves (Clarendon Lab., Oxford). Nuclear Phys. 8, 358-73(1958) Oct. (1)

The scattering matrix for the general N-channel reaction is diagonalized in the channel spin representation, and the eigen-phase-shifts and elements of the diagonalizing matrix are expanded in a power series about an arbitrary energy. Methods are given for calculating the coefficients in the series from numerical solutions of the wave equation, thus giving a complete generalization of the usual effective range theory to N-channel systems. (auth)

1684

SELF-SHIELDING EXPERIMENTS WITH GASEOUS AND SOLID B-10. G. P. Rutledge and R. R. Eggleston (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 4, 530-5(1958) Oct.

The relative reactivity worth of several $B^{10}F_3$ gaseous coupons has been determined at pressures up to 4.2 atmospheres. These worth values are compared with equivalent B^{10} loading as B_4C dispersed (100 mesh or less) in stainless steel. Gaseous boron is more than five times as effective as the dispersed boron due to particle self-shielding. Bulk self-shielding becomes important only at high concentrations. The gaseous coupons are also compared with two alloy coupons (normal B^{10} and enriched B^{10}). (auth)

1685

PRODUCTION CROSS SECTION OF N^{16} AND N^{17}. Paul A. Roys and Kalman Shure (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 4, 536-45 (1958) Oct.

The gamma-ray dose rate and the fast neutron flux have been measured in air from a source of water shortly after irradiation in the Materials Testing Reactor. Gamma rays from N^{16} and neutrons from N^{17} have been detected. From the measurements and the known geometry, the cross sections for the $O^{16}(n,p)N^{16}$ and the $O^{17}(n,p)N^{17}$ reactions averaged over the fission neutron spectrum have been deduced to be 0.019 mb and 0.0052 mb, respectively. The results are compared with other measured values and theoretical estimates. (auth)

1686

AGE TO INDIUM RESONANCE FOR D-D NEUTRONS IN WATER. V. Spiegel, Jr., D. W. Oliver, and R. S. Caswell (National Bureau of Standards, Washington). Nuclear Sci. and Eng. 4, 546-62(1958) Oct.

The average 1.44-ev indium resonance age has been determined from activation measurements for a $D(d,n)He^3$ neutron source in water. The energy of the incident deuteron beam was 250 kev. The source emits neutrons anisotropically with energies from 3.12 Mev at 0° to 2.00 Mev at 180°. The activities were averaged over angle by the Gauss integration procedure using angles of 20.3°, 90°, and 159.7°. The average age, when corrected for the absence of moderator in the duct which brings the deuteron beam into the medium, is 34.6 ± 2.2 cm^2. Rigorous theoretical calculations for a D + D neutron source by Zweifel give 33.6 cm^2 for 100-kev incident deuterons and 33.8 cm^2 for 150-kev deuterons. Any estimate of an age for a 250 kev D^+ source would yield a larger value of age and closer agreement with this experiment. The variation of our measured ages versus angle may be understood qualitatively on the basis of effects due to the duct and the anisotropy of the source. (auth)

1687

TOTAL NEUTRON CROSS SECTIONS FOR STRUCTURAL MATERIALS. R. J. Brown and L. M. Bollinger (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 4, 576-80(1958) Oct.

The total neutron cross sections of several structural materials have been measured over the thermal range of energy. A plate of commercial wrought nickel, thin sheets of 61S aluminum, and a cylinder of 2S aluminum of 3-in. diameter were studied. The results of the measurements are compared with previous results, and the observed differences are interpreted in terms of crystal structure. (auth)

1688

EFFECTIVE CROSS SECTIONS FOR THERMAL SPECTRA. C. H. Westcott (Atomic Energy of Canada Ltd., Chalk River, Ont., Can.). Nucleonics 16, No. 10, 108-10(1958) Oct.

Cross section values were obtained for Maxwellian neutron spectra (with and without an epithermal 1/E component) at temperatures from 20 to 760°C. The results for Sm, Gd, U^{235}, and the isotopes of Pu are given. (J.S.R.)

1689

THE DECAY OF NEODYMIUM-147. P. Rice Evans (Univ. of London). Phil. Mag. (8) 3, 1061-8(1958) Oct.

The β transitions from Nd^{147} were studied in the new prolate spheroidal field spectrometer. Three components of the spectrum were separated by $\beta-\gamma$ coincidence techniques. The γ-rays were studied in a scintillation counter and coincidences between conversion lines and γ-rays were recorded. On the basis of these results a new mode of decay for Nd^{147} is proposed. (auth)

1690

STRIPPING AT LOW ENERGIES. D. H. Wilkinson (Clarendon Lab., Oxford). Phil. Mag. (8) 3, 1185-8 (1958) Oct.

Deuteron-induced reactions of low Q-value show strikingly good stripping patterns at low deuteron bombarding energy (less than 2 Mev). High Q-values lead to bad stripping patterns. This is because, with a low Q-value, stripping can take place when the stripped nucleon is remote from its partner in the deuteron, and is therefore free from disturbing interactions. (auth)

1691

INTERACTIONS OF ANTIPROTONS IN NUCLEAR EMULSION. G. B. Chadwick and P. B. Jones (Clarendon Lab., Oxford). Phil. Mag. (8) 3, 1189-91(1958) Oct.

Preliminary results obtained from observations on the interaction of antiprotons in a nuclear emulsion stack exposed to an antiproton beam of the Bevatron are discussed. The energy of the antiproton beam, at the scanning line, was found to be 235 ± 10 Mev determined from the residual range distribution for those antiprotons which come to rest and produce a capture star with ≥ 1 prong. From this range distribution and from the distribution of the number of minimum ionizing particles produced by capture stars having no visible nuclear excitation, it is concluded that 7% of the tracks followed were protons. It is estimated that about three antiprotons come to rest and produce a capture star with no visible prongs, compared with 84 which give ≥ 1 prong. Two scattering events with free protons were found, in agreement with the cross section of 41^{+10}_{-7} mb for this process in the energy interval 30 to 215 Mev. The results of the investigation are tabulated. (A.C.)

1692

MAJORANA FORMULA. Alvin Meckler (National Security Agency, Fort Meade, Md.). Phys. Rev. 111, 1447-9(1958) Sept. 15.

The Majorana formula for the transition probability of a general spin is here rederived and brought into a more compact form. The method is based on the use of the projection operators which characterize the spin vector as definitely quantized along a specified unit vector. If the Hamiltonian contains only terms linear in the spin, it is possible to define a moving instantaneous axis along which the moving spin vector maintains its quantization. The Majorana problem is reduced to the calculation of the joint probability of quantization along two different axes. The usual expression of the Majorana formula contains a factor which is the transition probability of a spin-½ vector. It is shown here how this factor is related to the angle through which the general spin is turned. (auth)

1693

QUANTUM STATISTICAL THEORY OF ELECTRON CORRELATION. Robert D. Cowan (Los Alamos Scientific Lab., N. Mex.) and John G. Kirkwood (Yale Univ., New Haven). Phys. Rev. 111, 1460-6(1958) Sept. 15.

The average electrostatic potential distribution about a given electron is calculated for a system of point-charge electrons embedded in a neutralizing continuum of positive charge. The calculation is classical, involving a Poisson equation of the Debye-Hückel type, except that the electron density is treated by means of Fermi-Dirac statistics as in the Thomas-Fermi theory of the atom. The calculated energy due to electrostatic interactions agrees with the quantum-mechanical exchange plus correlation energy over the observed range of metal valence-electron densities, $2 \leq r_s \leq 6$, but is too small at larger and smaller densities. (r_s is the electron-sphere radius in units of the Bohr radius.) The equilibrium density (T = p = 0) occurs at $r_s = 4.3$, at which point the compressibility is 69 per megabar. The electronic specific heat is linear in T at low temperatures and varies from 0.9 to 0.74 of the Sommerfeld value over the observed metal density range. (auth)

1694

ATOMIC DISTRIBUTION IN LIQUID AND SOLID NEON AND SOLID ARGON BY NEUTRON DIFFRACTION. D. G. Henshaw (Atomic Energy of Canada Ltd., Chalk River, Ont., Can.). Phys. Rev. 111, 1470-5(1958) Sept. 15.

The angular distribution of 1.06_4 A neutrons scattered from liquid neon at 26.0 ± 1.5°K and 1.7 atmospheres and that from solid neon and solid argon at 4.2°K were measured over the angular range 5° to 64°. The transmission cross section of liquid neon was also measured and is 2.7 ± 0.3b for 1.06_4 A neutrons. The scattering pattern and corresponding distribution function $4\pi r^2[\rho(r)-\rho_0]$ for liquid neon are similar in form to those of other measured inert gases. A study of the distribution function gives 2.45, 3.17, and 8.8 A for the nearest distance of approach of two atoms, the most probable separation of, and the number of neighbors under, the first shell of atoms, respectively. It is concluded that the effective potential in the liquid has a broader bowl than that of the Lennard-Jones 12:6 and other similar potentials. The lattice parameters a_0 for the f.c.c. structures of solid neon and solid argon are 4.42_9 A and 5.25_6 A, respectively. The Debye temperature for solid neon corresponding to the intensity of the diffraction maxima is 73°K. The results suggest that the density change during the solid-liquid transformation cannot be accounted for by either a uniform depletion of atoms from, or a uniform dilation of, a basic structure. (auth)

1695

BOMBARDMENT OF CADMIUM SULFIDE CRYSTALS WITH 30- TO 60-kev ELECTRONS. C. E. Bleil, D. D. Snyder, and Y. T. Sihvonen (General Motors Research Staff, Detroit). Phys. Rev. 111, 1522-6(1958) Sept. 15.

The dependence of induced conductivity in CdS crystals on the rate of arrival and the energy of impinging electrons is reported. These results lead to a qualitative picture of the conduction, excitation, and recombination phenomena in CdS which is satisfied by the simple model of a sulfur vacancy, and an analytical expression which involves the mobility of carriers, their effective masses, the number of ground states in the forbidden gap (for pure but not perfect crystals) and their positions as a function of temperature. The red and green luminescence observed under irradiation by electrons is qualitatively explained. The equation for the induced conductivity is derived from the expression for two-carrier conductivity and the definitions of the steady-state Fermi levels for holes and electrons. An empirical fit to the observed data yields $\sigma = e\mu_n N_c \exp(kT\alpha I - E_{fn}{}^0)/kT$ for $I < I_s$ and $\sigma = e(\mu_n + \mu_p)N_v \exp[kT\beta(I-I_s) - E_{fp}{}^0]/kT$ for $I > I_s$. The data reported herein were obtained by using monoenergetic bombarding electrons in the range of 30 to 60 kev. An interesting field effect is reported but no clear interpretation is available to the authors. Corroborating data employing ultraviolet irradiation are described. (auth)

1696

MAGNETIC MOMENTS DUE TO ROTATION IN Li^6F AND Li^7F. Allan M. Russell (Syracuse Univ., N. Y.). Phys. Rev. 111, 1558-67(1958) Sept. 15.

A molecular beam electric resonance spectrometer was used to measure the Zeeman splitting of the hyperfine structure of Li^6F and Li^7F in the J = 1 rotational state. From these measurements the magnitudes of the rotational magnetic moments of these molecules were determined: $(\mu_J/J)_{Li^6F} = (0.0818^{+0.0005}_{-0.0003})$ nuclear magnetons per J. $(\mu_J/J)_{Li^7F} = (0.0642^{+0.0004}_{-0.0002})$ nuclear magnetons per J. Since the signs of the rotational magnetic moments could not be measured, the sign of the electric dipole moment was not determined experimentally. A complete expression for the rotational magnetic moment in a diatomic molecule is derived. When the rotational perturbation of the electron motion is neglected the complete expression is shown to reduce to an equation for the magnetic moment of two singly charged ions. This ion-pair approximation, applied to the molecule above, indicates that the values for the moments should be positive. The nonslip electronic contribution, neglected in the ion-pair approximation, is described in terms of a semiclassical model. Numerical evaluation of the nonslip electronic contribution to the rotational magnetic moment of Li^6F and the nuclear J-dependent magnetic field of the fluorine spin-rotation interaction yields results within 10% of experimental values. The model shows that these two molecular constants though the results of the same perturbation, arise from different parts of the charge distribution. (auth)

1697

FURTHER STUDIES OF ANOMALOUS INELASTIC PROTON SCATTERING. Bernard L. Cohen and Allen

G. Rubin (Oak Ridge National Lab., Tenn.). Phys. Rev. 111, 1568-77(1958) Sept. 15.

Anomalous inelastic proton scattering was studied by (1) determining its dependence on bombarding energy, (2) measuring the energy distributions with greatly improved energy resolution, (3) extending the data to separated isotopes and to elements not previously investigated because of target preparation difficulties, and (4) observing the energy distribution of the de-excitation gamma rays following the reaction. In (1), the anomalous peak is found to stay at the same Q value as the bombarding energy is varied. This indicates that the effect is not due to a giant resonance effect but rather, to the regular occurrence of a certain type of level in the final nucleus. In (2), many low-lying levels are resolved; a strong correlation is found between their cross sections for excitation in these reactions and in Coulomb excitation, and an anticorrelation is found between their cross sections for excitation in these reactions and in (p,d) reactions. This is interpreted as good evidence that the reactions used here strongly excite collective levels and only weakly excite single-particle transitions. The fine structures of the anomalous peaks differ greatly among neighboring nuclides reflecting even-versus-odd and closed-shell effects; however, the gross structure as obtained with poor resolution is very similar for neighboring elements. A few striking similarities between the spectra of several elements are pointed out. Several levels of known spin and parity are identified as contributing strongly to the anomalous peak. In (3), it is found that anomalous inelastic scattering ends by becoming irregular and weak between atomic numbers 54 and 64; it is apparently present in every isotope of every element between atomic numbers 30 and 53. In (4), gamma-ray transitions direct to the ground state following anomalous inelastic scattering are found to be relatively common. Many theoretical explanations for anomalous inelastic scattering are excluded by these results; there is reasonably good evidence that it arises from some type of collective excitation "dissolved" among many shell model states in that energy region. (auth)

1698

THEORY OF REACTIONS $H^3(d,n)He^4$ AND $He^3(d,p)He^4$. William S. Porter and John L. Johnson (Yale Univ., New Haven) and Benjamin Roth (Univ. of Connecticut, Storrs). Phys. Rev. 111, 1578-85(1958) Sept. 15.

The reactions $H^3(d,n)He^4$ and $He^3(d,p)He^4$ are fitted by using one-level and one-level-plus-background dispersion formulas and taking into account the implications of the principle of charge symmetry of nuclear forces. Fits are found by using a variety of penetration parameters and channel radii. The schematic treatment of Breit and the $\mathcal{R}$-matrix formalism of Wigner and Eisenbud are used to obtain the one-level-plus-background formulas and fits made by using them are compared with those obtained by previous workers using one-level formulas. The connection of these reaction fits with recent n + He^4 scattering data is discussed. (auth)

1699

BETA DECAY OF N^{16}. David E. Alburger (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 111, 1586-91 (1958) Sept. 15.

The positron-electron pair coincidence spectrum occurring in the beta decay of 7.4-sec N^{16} was examined at 1.25% resolution with an intermediate-image pair specrometer. A line is observed corresponding to internal pair conversion of the 6.14-Mev E3 transition from the 3 − second excited state to the 0 + ground state of O^{16}. The upper limit on the intensity of a 6.06-Mev nuclear pair line from the 0 + first excited state (electric monopole transition) is 10% relative to the 6.14-Mev line and this corresponds to an upper limit of 1.5×10^{-4} for the fractional beta decay to the 6.06-Mev level. A lower limit of 8.2 is derived for the log ft value of this $2- \rightarrow 0+$ beta-ray branch as compared with the known log ft = 6.7 for the $2- \rightarrow 0+$, 10.4-Mev branch to the ground state. (auth)

1700

EXTRAPOLATION PROCEDURE FOR THE LOW-ENERGY DEUTERON-DEUTERON REACTION CROSS SECTION. J. G. Brennan (U. S. Naval Ordnance Lab., Silver Spring, Md., and Catholic Univ. of America, Washington). Phys. Rev. 111, 1592-6(1958) Sept. 15.

A semiempirical study is made of the d-d reaction cross section to determine its energy dependence at low energy and to permit more reliable extrapolation to energies below the experimental range. An energy-dependent correction to the simple WKB form is shown to be indicated by experimental data. The energy-independent normalization factor is then determined by comparison with the experimental data over the range of 10 to 100 kev bombarding energy. This provides a cross-section formula which is more suitable for extrapolation to the region around one kev. (auth)

1701

RADIATIVE CAPTURE OF PROTONS IN OXYGEN AT 140 TO 170 kev. R. E. Hester, R. E. Pixley, and W. A. S. Lamb (Univ. of California, Livermore). Phys. Rev. 111, 1604-6(1958) Sept. 15.

The thick-target yield of the reaction $O^{16}(p,\gamma)F^{17}$ was measured by bombarding Al_2O_3 targets with protons from 140 to 170 kev using currents from 3 ma to 10 ma and counting the induced positron activity of the F^{17}. The thick-target yield ranges from $(1.9 \pm 1) \times 10^{-17}$ beta/incident proton at 140 kev to $(1.47 \pm 0.15) \times 10^{-16}$ beta/incident proton at 170 kev. The corresponding cross sections are $(4.6 \pm 2.4) \times 10^{-11}$ b at 140 kev and $(2.34 \pm 0.3) \times 10^{-10}$ b at 170 kev. The activity was identified by observing the half-life. The cross section factor S_0 was found to be 6.8 ± 1.4 kev-b between 140 and 170 kev bombarding energy. (auth)

1702

GAMMA-RAY DECAY IN Hg^{200}. R. E. Segel (Wright-Patterson Air Force Base, Dayton, Ohio). Phys. Rev. 111, 1620-30(1958) Sept. 15.

$\gamma-\gamma$ cascades following thermal neutron capture in Hg^{109} were measured. A three-crystal pair spectrometer was used to measure the high-energy gamma rays and a single NaI(Tl) crystal spectrometer detected the lower energy radiation. A detailed comparison is made between the experiment reported here, the previously known high-resolution mercury capture gamma-ray spectrum, and the previously measured decay scheme of Tl^{200}. Several discrepancies between the capture gamma ray and β-decay work are resolved, though others remain. By combining the results of the three experiments, probable spin and parity assignments are made for several of the low-lying levels in Hg^{200}. With these spin assignments, some conclusions are drawn as to the relative transition probabilities for the various multipolarity radiations present. (auth)

1703

THERMAL-NEUTRON-INDUCED FISSION OF Th^{229}. A. Smith, P. Fields, A. Friedman, and R. Sjoblom (Argonne National Lab., Lemont, Ill.). Phys. Rev. 111, 1633-5(1958) Sept. 15.

A back-to-back ionization chamber is used to measure the Th^{229} fission fragment kinetic energy distribution. This fission process is found to be the most asymmetric known, with a most probable mass ratio of 1.57. The measured total fragment energy is 160.2 ± 3 Mev. The experimental results are compared with the characteristics of other fission processes and with theory. (auth)

1704

(d,p) REACTIONS IN THE Pb ISOTOPES AND THEIR INTERPRETATION. M. T. McEllistrem, H. J. Martin, D. W. Miller, and M. B. Sampson (Indiana Univ., Bloomington). Phys. Rev. 111, 1636-42(1958) Sept. 15.

Q values and differential cross sections were measured for nuclear states excited by the $Pb^{206}(d,p)Pb^{207}$, $Pb^{207}(d,p)Pb^{208}$, and $Pb^{208}(d,p)Pb^{209}$ reactions. The known properties of the Pb^{206} ground state, the low-lying states of Pb^{207}, and the Pb^{208} ground state are used to confirm the possibility of a stripping interpretation for these reactions. This interpretation is used to suggest possible assignments for the other observed states in Pb^{207} and Pb^{209}; in particular, the ground state of Pb^{209} is consistent with a $g_{9/2}$ assignment. The first excited state of Pb^{209} does not seem to behave like a single-particle state. (auth)

1705

ELECTRODISINTEGRATION OF Be^9 AND C^{12}. W. C. Barber (Stanford Univ., Calif.). Phys. Rev. 111, 1642-50(1958) Sept. 15.

Yields from the reactions $Be^9(e,e'n)$ and $Be^9(\gamma,n)$, as well as the relative yields from $C^{12}(e,e'n)C^{11}$ and $C^{12}(\gamma,n)C^{11}$, were measured under conditions which permitted a comparison of the relative effects of electrons and bremsstrahlen from electrons in producing nuclear reactions. The primary electron energies were from 6 to 17 Mev in the case of Be, and 24 to 145 Mev in the case of C. Comparison of the experimental results with the theory of electrodisintegration gives information about the multipole order of the electromagnetic transitions involved. The Be^9 results agree with theory if the reaction mechanism is predominantly electric-dipole. For C^{12}, a mixture of 92% electric-dipole with 8% electric-quadrupole intensities give agreement with theory over the energy range 28 to 145 Mev, provided that the finite size of the C nucleus is taken into account. The method of considering the finite nuclear size in the theory is presented, and the results previously obtained by Reagan for the reactions $F^{19}(e,e'2p)N^{17}$ and $F^{19}(\gamma,2p)N^{17}$ are shown to be in good agreement with the modified theory for an electric-quadrupole transition. (auth)

1706

REMARKS ON PION PRODUCTION IN PION-NUCLEON COLLISIONS AT MODERATE ENERGIES. Saul Barshay (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 111, 1651-7(1958) Sept. 15.

Some remarks are made concerning pion production in pion-nucleon collisions at incident kinetic energies of from 300 to about 600 Mev. A certain representation of the matrix element is discussed which involves explicitly a term that is dependent upon a pion-pion scattering amplitude off the energy shell. A partial-wave decomposition of the rest of the transition operator is attempted upon the assumption that the amplitudes so introduced contain the effect of strong pion-nucleon interactions in the P wave. Quantities, such as the angular distribution and the polarization of the recoil nucleon, which may be determined largely by the interference between the amplitudes involving specific pion-pion and pion-nucleon effects, are also discussed. (auth)

1707

MONTE CARLO CALCULATIONS OF HIGH-ENERGY NUCLEAR INTERACTIONS. I. SYSTEMATICS OF NUCLEAR EVAPORATION. I. Dostrovsky (Brookhaven National Lab., Upton, N. Y., and Weizmann Inst. of Science, Rehovoth, Israel), P. Rabinowitz (Weizmann Inst. of Science, Rehovoth, Israel), and R. Bivins (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 111, 1659-76(1958) Sept. 15.

The process of nuclear de-excitation by evaporation was calculated by using a Monte Carlo method and fast electronic computers. The competition between the emission of neutrons, protons, deuterons, tritons, He^3, and He^4 was studied as a function of various parameters and experimental conditions. A systematic survey is presented for a range of atomic numbers, mass numbers and excitation energy of initial nuclei. The nuclides studied extend from $A = 49$ to 239 with $Z = Z_A \pm 3$. The range of excitation energies for which computations are presented extends from 100 to 700 Mev. Among the parameters affecting the process the importance of the temperature correction of the Coulomb barrier and the level density parameters are considered in detail. The average properties of the process such as average numbers of the various particles emitted, the average number of nucleons, of charged particles, and of charges emitted are summarized in graphical and tabular form for various combinations of the parameters used in the computation. Energy spectra of the various emitted particles are also shown. (auth)

1708

π^--p INTERACTIONS AT 1.85 Bev/c. R. C. Whitten and M. M. Block (Duke Univ., Durham, N. C.). Phys. Rev. 111, 1676-83(1958) Sept. 15.

Cloud chamber results on elastic and inelastic scattering in hydrogen of pions having a momentum in the laboratory system of 1.85 Bev/c are reported. The elastic scattering data are consistent with diffraction by a sphere of radius 0.85 f and opacity 0.9. The forward scattering amplitude was found to be in agreement with that derived from the dispersion relations. Investigation of the inelastic scattering disclosed that there is little agreement with the predictions of the Fermi statistical model. The angular and Q value distributions of the particles emerging from inelastic interactions showed little agreement with either the statistical theory or the excited isobar model. (auth)

1709

PHOTON DECAY OF HYPERONS. R. E. Behrends (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 111, 1691-7(1958) Sept. 15.

The photon mode of decay of the Σ^+ and Λ^0 is examined. The lifetime and angular distributions of the decay products are written in terms of the three physical parameters of the problem without restriction as to invariance under space reflection, charge conjugation, or time reversal. An estimate of these parameters is made by use of perturbation theory, and, although ambiguous, it indicates that this mode may soon be experimentally detectable. (auth)

1710

EMPIRICAL MODEL FOR ULTRARELATIVISTIC NUCLEON-NUCLEON COLLISIONS. Giuseppe Cocconi (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 111, 1699-1706(1958) Sept. 15.

The interaction of ultrarelativistic ($\geq 10^{12}$ ev) primary cosmic protons with nucleons in photographic plates observed thus far show that in the majority of the cases the secondaries are emitted isotropically from two centers; this fact and the observation that the average transverse momentum of the secondaries is independent both of the energy of the primary nucleon and of the energy of the secondaries themselves suggest the following empirical model. When a nucleon-nucleon collision takes place at these energies, two "bodies" are formed, that move in opposite directions with respect to the center of momentum of the system, together with the two original nucleons, stripped of the energy necessary to create the "bodies." Each "body" emits, in its own system of reference, about half of the total number of secondaries, each secondary having an average energy of ~1 Bev, independent of its nature. The inelasticity of the collision is thus determined by the number of secondaries and by the velocity of each "body" in the center-of-momentum system of the two original nucleons. Accurate determinations of the energy, in the laboratory system, of the secondaries of these interactions could provide a sensitive test for the model, but at present there are too few measurements available. (auth)

1711

FOURTH-ORDER NUCLEON-NUCLEON DISPERSION RELATIONS. M. T. Grisaru (Princeton Univ., N. J.). Phys. Rev. 111, 1719-26(1958) Sept. 15.

The fourth-order contribution to the nucleon-nucleon scattering amplitude is shown to satisfy the conditions necessary for writing dispersion relations. The imaginary part is explicitly calculated and shown to agree with the absorptive part obtained from general principles. (auth)

1712

NUCLEAR SPIN OF 12.6-HOUR IODINE-130. Hugh L. Garvin, Thomas M. Green, and Edgar Lipworth (Univ. of California, Berkeley). Phys. Rev. Letters 1, 292-3 (1958) Oct. 15.

The nuclear spin of 12.6-hr I^{130} was measured by means of an atomic-beam magnetic-resonance experiment and found to be 5. The I^{130} was produced in the Berkeley 60-inch cyclotron by bombarding Te^{130} with 12-Mev protons. (W.D.M.)

1713

LEVEL INVERSION IN THE HYPERFINE STRUCTURE OF BROMINE-76. NUCLEAR MOMENTS OF BROMINE-76. H. L. Garvin, T. M. Green, E. Lipworth, and W. A. Nierenberg (Univ. of California, Berkeley). Phys. Rev. Letters 1, 293-5(1958) Oct. 15.

In the course of an investigation of 17-hr Br^{76} by the method of atomic beams, it was established that the ratio of the nuclear electric quadrupole and magnetic dipole interaction constants is such that the zero-field hyperfine levels, $F = 3/2$ and $1/2$, do not occur in normal order. This inversion is discussed. (W.D.M.)

1714

SPIN OF Fe^{57}. G. W. Ludwig, H. H. Woodbury, and R. O. Carlson (General Electric Research Lab., Schenectady, N. Y.). Phys. Rev. Letters 1, 295-6(1958) Oct. 15.

The spin of the stable isotope Fe^{57} was directly observed to be $1/2$ from the electron spin resonance spectrum of iron-doped silicon. Samples were prepared by alloying several milligrams of 84.1% enriched iron onto silicon crystals. The iron was diffused into the silicon bars by placing them in evacuated quartz tubes held at 1200°C for 24 hours. (W.D.M.)

1715

SPIN AND MAGNETIC DIPOLE MOMENT OF 2.6-HR Mn^{56}. W. J. Childs, L. S. Goodman, and L. J. Kieffer (Argonne National Lab., Lemont, Ill.). Phys. Rev. Letters 1, 296(1958) Oct. 15.

Progress to date on atomic beam magnetic resonance measurements of the nuclear spin of Mn^{56} is reported. Tentative results indicate a spin of $I = 3_{\hbar}$ and a magnetic dipole moment $\mu = 3.53 \pm 0.01$ nm. (W.D.M.)

1716

ANGULAR CORRELATION OF ALPHA PARTICLES FROM DECAY OF Li^8. T. Lauritsen, C. A. Barnes, W. A. Fowler, and C. C. Lauritsen (California Inst. of Tech., Pasadena). Phys. Rev. Letters 1, 326-8(1958) Nov. 1.

It has been pointed out that the decay of Li^8 provides a very convenient means of studying the nature of beta decay interaction because of the high energy decay of Li^8 and its daughter nucleus Be^{8*}. The distribution in angle between the alpha particles was determined by counting techniques in order to obtain better statistics. The physical arrangement consisted of a Li^8 source, produced by deuteron bombardment of Li^7, placed midway between two aperture systems. It was concluded that Li^8 has a spin and parity 2^+, and that the beta decay interaction is at least 90% Gamow-Teller. (W.D.M.)

1717

NATURE OF THE Li^8 BETA-DECAY INTERACTION. C. A. Barnes, W. A. Fowler, H. B. Greenstein, et al (California Inst. of Tech., Pasadena). Phys. Rev. Letters 1, 328-30(1958) Nov. 1.

Li^8 was produced by bombarding a thin layer of Li^7 on a 0.005-inch aluminum backing, with a deuteron beam pulsed at 60 pulses per second. During the periods when the beam was cut off, alpha particles following the Li^8 beta decay were magnetically analyzed and detected in a CsI(Tl) crystal in coincidence with electrons. The measured alpha particle momentum spectra are shown. Corrections to the experimental data were made for the He^+/He^{++} ratio and for the momentum loss of the alpha particles in escaping from the target. (W.D.M.)

1718

CIRCULAR POLARIZATION OF EXTERNAL BREMSSTRAHLUNG PRODUCED BY BETA RAYS. S. Galster and H. Schopper (Johannes Gutenberg-Universität, Mainz). Phys. Rev. Letters 1, 330-2(1958) Nov. 1.

For energies smaller than 600 kev, the polarization was previously measured using forward scattering from magnetized iron, but a quantitative comparison was not performed. Computations were done for monoenergetic electrons falling on a thin absorber, whereas in all experiments the whole beta spectrum and thick absorbers were used. It is shown that even in this case a comparison with theory is possible as the diffusion of the electrons in the absorber has practically no influence on the polarization. Strong dependence of the circular polarization on the atomic number of the absorber is investigated. (W.D.M.)

1719

CHARGE TRANSFER OF PROTONS IN EXCITED ATOMIC HYDROGEN. T. J. M. Boyd and A. Dalgarno (Queen's Univ. of Belfast). Proc. Phys. Soc. (London) 72, 694-700(1958) Nov.

Resonance charge transfer cross sections are calculated for protons in atomic hydrogen in the ground and first two excited states. The cross sections for an excited atom are nearly an order of magnitude larger than those for the ground state. (auth)

1720

ON THE USE OF THE ADIABATIC THEORY IN ELECTRON-ATOM COLLISION CALCULATIONS. V. M. Martin, M. J. Seaton, and J. B. G. Wallace (University Coll. London). Proc. Phys. Soc. (London) 72, 701-10(1958) Nov.

The adiabatic theory allows for perturbation of the atom by treating the colliding electron as a fixed point charge. The form of the wave functions obtained may be shown to be correct in the limit of large separations. Numerical results are discussed for the s- and p-phases in electron–hydrogen collisions. It is considered that the adiabatic theory over-estimates the effect of perturbations of the atom for separations of order 1 atomic unit. The error introduced for the s-wave may be particularly large. (auth)

1721

THE PROBABILITY OF MULTIPLE EMISSIONS OF SECONDARY ELECTRONS. R. E. Barrington and J. M. Anderson (Univ. of Toronto). Proc. Phys. Soc. (London) 72, 717-26(1958) Nov.

Probabilities P_n were determined for the emission of electrons in groups of n numbering from zero to eight occurring as a result of single primary. Beryllium copper surfaces under different activation conditions were studied for primary energies between 100 and 300 ev, P_0, having values between 0.5 and 0.2 falling to a minimum at intermediate energies, and P_1 with values 0.3 to 0.4 rising to a maximum at intermediate energies remain larger than any other probability. Probabilities above P_1 for constant primary energy fall off with number in two distinct curves, that for even numbers lying above and falling less steeply than that for odd numbers. Separation of these curves depends on surface treatment. For activated surfaces probabilities P_1 to P_6 show evidence of maxima in the energy range covered; P_7 and P_8 are still rising at the end of the range. For unactivated surfaces only P's for odd numbers of electrons show a clear decrease at higher energies; P's for even numbers of electrons, with the possible exception of P_2, are still rising at the end of the range. (auth)

1722

THE ELASTIC SCATTERING OF PROTONS BY TRITONS AND ^{3}He. B. H. Bransden (Univ. of Glasgow) and H. H. Robertson (National Physical Lab., Teddington, Middlesex, Eng.). Proc. Phys. Soc. (London) 72, 770-80(1958) Nov.

Earlier work on the elastic scattering of neutrons by tritons and He^3 was extended to proton scattering over the energy range 1 to 14 Mev. Cross sections and phase shifts are calculated assuming central two body interactions, of various exchange types and of Gaussian radial form. Comparison with experiment favors the Serber rather than the symmetrical type of exchange interaction. However, detailed agreement between the calculated and experimental cross sections is lacking at the lowest energies. (auth)

1723

THE EXCITATION OF HELIUM BY ELECTRONS OF LOW ENERGY. S. J. B. Corrigan and A. von Engel (Clarendon Lab., Oxford). Proc. Phys. Soc. (London) 72, 786-90(1958) Nov.

An analysis was made of the main excitation processes caused by an electron swarm passing through helium. Recent experimental studies of energy losses of monoenergetic electron beams in helium together with published theoretical excitation functions were used to obtain approximate cross sections for the principal transitions leading to metastable and resonance states. The energy balance for an electron swarm in helium is derived and compared with that found previously for molecular hydrogen. (auth)

1724

THE K-SHELL IONIZATION OF ATOMS BY HIGH-ENERGY ELECTRONS. A. M. Arthurs and B. L. Moiseiwitsch (The Queen's Univ. of Belfast). Proc. Roy. Soc. (London) A247, 550-6(1958) Oct. 21.

An expression for the cross-section for K-shell ionization of atoms by electrons is obtained by using Møller's relativistic modification of the Born approximation. Results are presented for the elements with atomic numbers less than 30. For nickel the calculated cross-sections are in good agreement with those measured by Kirkpatrick and his collaborators, a marked improvement due to the allowance for relativistic effects being found at high energies of impact. The normalization of the wave function of the ejected electron is discussed in the appendix. (auth)

1725

DETERMINATION OF THE TOTAL CROSS SECTION FOR THE D(d,n)He^3 REACTION IN THE ENERGY REGION 20–220 kev. V. A. Davidenko, A. M. Kucher, I. S. Pogrebov, and Iu. F. Tuturov (Inst. for Nuclear Problems, Academy of Sciences, USSR). Soviet J. Atomic Energy (English Translation) Suppl. No. 5, 7-12(1958).

Measurements of the cross section for the D(d,n)He^3 reaction in the deuteron energy range 20 to 220 kev in thick targets of heavy ice are reported. The neutron yields obtained are tabulated, graphed, and compared with the results of other workers. The values of the cross sections computed from empirical formulas agree with the experimental values to within ± 5%. (J.S.R.)

1726

INVESTIGATION OF THE D-D REACTION IN THE DEUTERON ENERGY RANGE OF 0.20-1.75 Mev. V. V. Volkov, P. E. Vorotnikov, et al. Soviet J. Atomic Energy (English Translation) Suppl. No. 5, 13-20(1958).

The angular distributions and total cross sections for the D(d,p)T reaction were investigated. The differential and total cross sections for the reaction in the energy range from 0.20 to 1.75 Mev are given. A comparison of the cross sections for the D(d,p)T and D(d,n)He^3 reactions was made. The neutron angular distribution appears to be more anisotropic than the proton distribution. (J.S.R.)

1727

THE D-D REACTION IN THE DEUTERON ENERGY RANGE 100–1000 kev. A. S. Ganeev, A. M. Govorov, et al. Soviet J. Atomic Energy (English Translation) Suppl. No. 5, 21-36(1958).

A study was made of the ratio of the cross section and the angular distribution of the products in the reactions D(d,n)He^3 and D(d,p)T in the energy range from 100 to 1000 kev. The results are tabulated and graphed. To determine the ratio of the cross sections for the reactions, simultaneous measurements were made of the yield of charged particles produced. A comparison of the angular distribution for the products of both reactions indicates that the angular distributions of the neutrons are more asymmetrical than those of the proton and that the difference in asymmetry increases with increasing deuteron energy. (J.S.R.)

1728

MEASUREMENTS OF THE YIELDS AND EFFECTIVE CROSS SECTIONS OF THE D(t,n)He^4 AND D(d,p)T REACTIONS USING THICK TARGETS OF HEAVY ICE. E. M. Balabanov, I. Ia. Barit, et al. Soviet J. Atomic Energy (English Translation) Suppl. No. 5, 37-42(1958).

Measurements of the yield and effective cross sections for the D(t,n)He^4 and D(d,p)T reactions using heavy ice in the energy range from 50 to 200 kev are reported. The results are graphed, and the yield measurements were reproducible to within 3% for the D(d,p)T reaction and 2 to 2.5% for the D(t,n)He^4 reaction. A comparison is made with other results, and the origin of the discrepancies is discussed. (J.S.R.)

1729

MEASUREMENT OF THE EFFECTIVE CROSS SECTION FOR THE D(t,n)He^4 REACTION IN THE DEUTERON ENERGY RANGE 40–730 kev. E. M. Balabanov, I. Ia. Barit, et al. Soviet J. Atomic Energy (English Translation) Suppl. No. 5, 43-52(1958).

Investigations were made to obtain reliable values for the effective cross section in the region of the maximum and to determine its value. A gas target was used. The results show a maximum at 106 kev on the deuteron energy scale. The possible systematic errors are discussed. The cross section at the maximum was 5.22 barns, in excellent agreement with previous data. (J.S.R.)

1730

TOTAL TRITIUM CROSS SECTION FOR NEUTRONS WITH ENERGIES OF 2.5 AND 14 Mev. L. N. Katsaurov, R. M. Musaelian, and V. I. Popov. Soviet J. Atomic Energy (English Translation) Suppl. No. 5, 53-5(1958).

The total tritium cross section for 2.5- and 14-Mev neutrons was measured by comparing the transmission of ordinary water and water containing tritium at a concentration of 9.2%. The results were 2.5 ± 0.5 and 0.63 ± 0.17 barns for 2.5- and 14-Mev neutrons, respectively. There is agreement with previous experimental results and with the theoretical results for 14-Mev neutrons. The experimental results for 2.5-Mev neutrons do not, however, agree with theory. (J.S.R.)

1731

MEASUREMENT OF THE EFFECTIVE CROSS SECTION FOR THE $Li^6(n,\alpha)$ REACTION FOR 2.5-Mev NEUTRONS. A. V. Elpidinskii, F. L. Shapiro, and I. V. Shtranikh. Soviet J. Atomic Energy (English Translation) Suppl. No. 5, 56-66(1958).

The results of measurements of the effective cross section for the $Li^6(n,\alpha)T$ reaction for D-D neutrons with an energy of 2.5 Mev obtained by an ionization method are reported. The interpretation of the pulse spectrum is discussed. The shape of the spectrum was calculated for thermal and D-D neutrons and compared with the experimental values. In the thermal neutron case, the theoretical and experimental curves are in satisfactory agreement. In the case of the D-D neutrons, the curves are of the same shape, but the distance between peaks in the experimental curve is smaller than the calculated distance. The cross section of the $Li^6(n,\alpha)T$ reaction for 2.5-Mev D-D neutrons was $\sigma = (170 \pm 20) \times 10^{-27}$ cm^2, in good agreement with previous results. In appendices, the calculation of the total-energy distribution for the products of lithium disintegration by slow and monoenergetic fast neutrons is given. (J.S.R.)

1732

TOTAL EFFECTIVE CROSS SECTIONS OF Li^6 AND Li^7 FOR NEUTRONS WITH ENERGIES OF 2.5 AND 14 Mev. L. N. Katsaurov, R. M. Musaelian, and V. I. Popov. Soviet J. Atomic Energy (English Translation) Suppl. No. 5, 67-8(1958).

The total effective cross sections of Li^6 and Li^7 for 2.5- and 14-Mev neutrons were measured on samples containing 91.7% Li^6 and 8.3% Li^7 and on samples of natural lithiun with 92.5% Li^7 and 7.5% Li^6. The values obtained were 1.40 ± 0.14b and 1.37 ± 0.06b for Li^6 at 2.5 and 14 Mev, respectively, and 2.0 ± 0.3b and 1.35 ± 0.08b for Li^7 at 2.5 and 14 Mev. The results are in good agreement with previous results, except for the Li^6 data at 2.5 Mev. (J.S.R.)

1733

EFFECTIVE CROSS SECTION FOR THE $Be^9(n,\alpha)He^6$ REACTION. S. S. Vasil'ev, V. V. Komarov, and A. M. Popova. Soviet J. Atomic Energy (English Translation) Suppl. No. 5, 69(1958).

In the measurement of the $Be^9(n,\alpha)He^6$ reaction cross section, specially fabricated photoemulsions, containing a powder ($\sim 1\mu$) of spectrally pure Be, were used. The emulsions were exposed to neutrons from a lithium target bombarded by 4-Mev deuterons. The results of the measurements for 1- to 7-Mev neutrons are tabulated. (J.S.R.)

1734

SPECIFIC STOPPING POWER OF NICKEL FOR 150–1100-kev PROTONS. G. M. Osetinskii. Soviet J. Atomic Energy (English Translation) Suppl. No. 5, 70-3(1958).

The results of measurements on the energy loss in Ni of 150 to 1100 kev protons are reported. The measurements were made by a magnetic spectrometer method and by measurement of the displacement of resonances in the F(p,α) reaction. The resonance displacement method gives results which are 7% higher than those obtained by the magnetic spectrometer method. The final values are tabulated and compared with previous results. (J.S.R.)

1735

NUCLEAR ABSORPTION CROSS SECTIONS FOR γ RADIATION BETWEEN 10 AND 30 Mev. B. Ziegler (Technische Hochschule Karlsruhe, Ger.). Z. Physik 152, 566-73(1958). (In German)

The bremsstrahlung spectra of a 32-Mev betatron were measured with a pair spectrometer. The light intensity of the spectrometers permitted the measurement of the spectra behind dense absorbers of Au, Cu, Al, H_2O, and C. The curve obtained contained characteristic indentations in the values of the quanta energy, which corresponds to the "gigantic resonance" of the atomic nucleus. The curve without absorber was multiplied by the known data for absorption by the Compton effect and pair formation and caused to coincide with the absorber curve beyond the gigantic resonance. The nuclear absorption cross section found agrees, within the measuring errors, with known values for carbon. For carbon, an integrated value of 30 ± 10 Mev mb was found. This is approximately ⅓ of the values added from the (γ,n) and (γ,p) measurements. (tr-auth)

1736

THE γ SPECTRUM OF RaD AND THE FACTOR OF INTERNAL CONVERSION IN THE 46.5-kev TRANSITION OF Bi^{210}. Ingrid Yvonne Krause (Univ. of Göttingen, Ger.). Z. Physik 152, 586-90(1958). (In German)

Measurements with a NaI scintillation spectrometer showed that uncoverted 46.5-kev quanta were emitted in 4.05 ± 0.08% of the RaD (Pt^{210}) decays. Therefore, with the L conversion processes in 63 ± 3% of the decays, the factor for the internal transition in the L shell is $\alpha_L = 15.6 \pm 0.8$. The measured value is somewhat higher than that for M 1 transitions and factors calculated with a nuclear radius of $R = 1.2 \times 10^{-13} A^{1/3}$ cm. It can be shown that the RaD emits no radiation with an energy over 30 kev except the 46.5-kev radiation. Its intensity must be lower than 4×10^{-5} quanta per RaD decay. (tr-auth)

1737

THE HYPERFINE STRUCTURE IN THE SPECTRUM OF LUTETIUM AND THE NUCLEAR MOMENT OF Lu^{175} AND Lu^{176}. Andreas Steudel (Univ. of Heidelberg, Ger.). Z. Physik 152, 599-623(1958). (In German)

The hyperfine structures of 6 Lu I and 6 Lu II lines were investigated in a natural isotopic mixture with a photoelectric recording Fabry-Perot spectrometer in order to obtain more accurate intensity measurements than are possible with photographic plates. From intensity measurements on 5 lines the nuclear angular momentum quantum number of the rare isotope Lu^{176} appeared as $I = 6 \pm 1$, so that the value 6 is correct with great probability. Measurement of the component distances of Lu^{176} confirmed this result. For the ratio of the magnetic dipole moments and the ratio of the nuclear electric quadrupole moments of Lu^{175} and Lu^{176} the values $\mu_I^{175}/\mu_I^{176} = 0.7175 \pm 0.0050$ and $Q^{175}/Q^{176} = 0.69 \pm 0.04$ were obtained. The accuracy of the absolute determination of the moments $\mu_I^{175} = 2.0 \pm 0.2$ KM and $Q^{175} = (5.6 \pm 0.6) \times 10^{-24}$ cm^2 was limited by the term perturbation in the Lu I and Lu II spectra. Fine structure and hyperfine structure in the Lu III spectrum were discussed. (tr-auth)

1738

ENERGY DEPENDENCE OF THE ANGULAR CORRELATION OF POSITRONS FROM THE $\pi \rightarrow \mu \rightarrow$ e-DECAY. Kh. P. Babayan, N. A. Marutyan, K. A. Matevosyan, and M. G. Sarinyan (Inst. of Physics, Academy of Sciences of Armenian SSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 561-4(1958). (In Russian)

The energy dependence of the angular correlation of positrons was investigated for 405 $\pi \rightarrow \mu \rightarrow$ e-decay events in nuclear emulsions. The experimental energy dependence of the backward-forward ratio for the emitted positrons agrees with the predictions of the two-component neutrino theory. (tr-auth)

1739

PRODUCTION OF TRITIUM IN METALS UNDER THE ACTION OF 120 TO 660 MeV PROTONS. V. V. Kuznetsov and V. N. Mekhedov (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 35, 587-91 (1958). (In Russian)

Results of an investigation of the formation of tritium in various elements induced by 660 Mev protons are presented. The excitation functions for tritium formation in aluminum and lead in the 120 to 660 Mev energy range are given. (tr-auth)

1740

ON TRIPLE SPALLATION OF URANIUM NUCLEI. N. A. Perfilov and G. F. Denisenko (Radium Inst., Academy of Sciences USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 631-4(1958). (In Russian)

Spallation of uranium nuclei into three multicharged particles by 460 and 660 Mev protons was studied. Two of the spallation particles were of the heavy fragment type and the third was of considerably smaller mass and charge. The yields for the indicated proton energies, angular distribution of light multicharged particles (forward-backward ratio), and their charge and energy distribution were determined for the triple disintegrations mentioned above. A suggestion concerning the mechanism of creation of such triple spallation is proposed and under the assumptions thus made the fragmentation cross section for uranium nuclei is estimated. (tr-auth)

1741

ANGULAR CORRELATION FOR LOW ENERGY POSITRONS EMITTED IN $\pi^+ - \mu^+ - e^+$-DECAY. A. O. Waisenberg, V. A. Smirnitskii, E. D. Kolganova, et al. Zhur. Eksptl'. i Teoret. Fiz. 35, 645-8(1958). (In Russian)

The energies of 1099 positrons from $\pi^+ \rightarrow \mu^+ \rightarrow$ e-decays in photographic emulsions and the angles ϑ between the direction of emission of the μ-mesons and positrons were measured. It is shown that in the energy regions $\epsilon = (0 \div 0.3)$, $(0.3 \div 0.6)$ and (> 0.9) the asymmetry coefficient or cos ϑ which is proportional to it are respectively equal to + 0.18 ± 0.10, 0.00 ± 0.04 and −0.09 ± 0.04 (ϵ is the positron energy in units of maximal energy). 201 low energy positrons ($\epsilon < 0.3$) were selected and measured from a total of 8000 $\pi^+ \rightarrow \mu^+ \rightarrow e^+$-decay events. For these positrons cos v = +0.07 ± 0.05. An estimate based on the χ^2 criterion shows that the probability of positive asymmetry in the 0 to 0.3 energy range is close to 95%. (tr-auth)

1742

FORMATION OF HYDROGEN MESIC MOLECULES. Ya. B. Zeldovich and S. S. Gerstein (Inst. of Problems in Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 649-54(1958). (In Russian)

An effective mechanism of formation of hydrogen mesic molecules is indicated. It consists in transition from the S-wave in the repulsion state to the rotational level K = 1 with transfer of the energy to a conversion electron. The calculations yield a value $\sim 1.5 \times 10^6$ sec^{-1} for the probability of formation of a mesic molecule $(pp)_\mu^+$ in liquid hydrogen. The process under consideration is significant for catalysis of the p + d-nuclear reaction and also for operation of the $\mu^- + p \rightarrow n + \nu$ process in liquid hydrogen. (tr-auth)

1743

ON POLARIZATION OF THE NUCLEAR MOMENTS AND THE NUCLEAR RESONANCE LINE WIDTHS IN CRYSTALS OF THE Cu^{++} ION SALTS. Sh. Sh. Bashkirov and K. A. Valiev (Kazan State Pedagogical Inst.). Zhur. Eksptl'. i Teoret. Fiz. 35, 678-84(1958). (In Russian)

Probabilities of nuclear relaxation transitions in Cu^{2+} ion salts are computed. The magnitude of nuclear polarization appearing on saturation of electron and nuclear resonance transitions is calculated. The effect of electron and nuclear relaxation on broadening of the nuclear resonance lines in paramagnetic atoms is considered. (tr-auth)

1744

OPTICAL MODEL OF THE INTERACTION BETWEEN INTERMEDIATE ENERGY AND NUCLEI. A. V. Lukyanov, Yu. V. Orlov, and V. V. Turovtsev (Moscow State Univ.). Nuclear Phys. 8, 325-37(1958) Oct. (1)

An optical model of the nucleus is investigated in which a complex potential with a tail expressed by a third degree polynomial is employed. Parameters of the model which give the best fit between the theoretical cross sections σ_t, σ_r, and σ_s and the experimental values for 14 Mev neutrons were determined. The agreement is quite satisfactory for nuclei heavier than the chromium nucleus. The elastic scattering neutron angular distributions computed with aid of these parameters also satisfactorily agree with experiment. A preliminary investigation at lower energies indicates that in a relatively broad range the parameters depend only weakly on the energy. (auth)

1745

THE SELECTION RULES IN REACTIONS WITH POLARIZED PARTICLES. Chzhou Guan-Chzhao (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 35, 783-5(1958). (In Russian)

Selection rules are developed for arbitrary initial state polarization. (R.V.J.)

1746

CALCULATIONS OF NEUTRON FISSION SPECTRA. V. P. Kovalev and V. S. Stavinskii. Zhur. Eksptl'. i Teoret. Fiz. 35, 787-9(1958). (In Russian)

Neutron fission spectra were calculated considering the energy dependence of cross sections in neutron capture by excited nuclei. The model of complex potential was used in an evaluation of the energy dependence. The neutron fission spectra for U^{235} and Cf^{252} were calculated. (R.V.J.)

1747

ON THE POSSIBLE ESTIMATE OF MEAN LIFE-TIME IN α SUBSTRUCTURE IN NUCLEI. Yu. I. Serebrennikov (Leningrad Polytechnical Inst.). Zhur. Eksptl'. i Teoret. Fiz. 35, 789-91(1958). (In Russian)

A knock-out of α substructure from nuclei is studied in order to determine the possibility for evaluating experimentally the mean life-time values of substructures inside nuclei. (R.V.J.)

1748

ON THE FIRST EXCITATION STATE OF Tb^{159}. Yu. A. Nemilov, A. N. Pisarevskii, and L. D. Soshin (Radium Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 800-1(1958). (In Russian)

The transition of the Tb^{159} first-excited state occurs with K x ray emission due to the strong conversion of the 57.5-kev line. The conversion coefficient is $\geq$ 99%.

1749

INVESTIGATION OF γ RAYS IN As^{78} DECAY. Yu. A. Nemilov, A. N. Pisarevskii, and L. D. Soshin (Radium Inst., Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 801-2(1958). (In Russian)

A hypothetical decay scheme of As^{78} is presented. It is assumed that As^{78} is in a metastable state at 500 kev. (R.V.J.)

1750

NEW MEASUREMENTS OF NEUTRON SPECTRA FORMED IN Be BOMBARDMENT BY 680 Mev PROTONS. V. S. Kiselev, K. O. Oganesyan, R. A. Poze, and V. B. Flyagin (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 35, 812-14(1958). (In Russian)

The use of magnetic fields in the analysis of recoil protons by pulses eliminated the admixture of $\pi^\pm$ mesons in the investigated range of energies. The new measurements were made for neutron yield at 0°. Special attention was given to the high-energy portion of the spectrum. The experimental scheme and the results for neutron spectra corrections are presented diagrammatically. The calculations considered the proton energy losses in the targets and air as well as the magnetic system astigmatism. The exclusion of $\pi^\pm$ mesons and the detector with improved resolving power showed that the maximum, found at 610 Mev, has a somewhat smaller half-width (~ 100 Mev) than was found by V. S. Kiselev (JETP 32, 962(1957)). (R.V.J.)

1751

RELATIVE YIELDS OF RETARDED NEUTRONS IN U^{238}, U^{235}, AND Th^{232} FISSION BY FAST NEUTRONS. B. P. Maksyutenko. Zhur. Eksptl'. i Teoret. Fiz. 35, 815-16(1958). (In Russian)

Relative yields of retarded neutrons were measured for natural U^{235} (90% enrichment) and Th^{232} from fission by 15.0 ± 0.9, 3.3 ± 0.7, and 2.4 ± 0.3 Mev neutrons. Measurements were made on specimens of U^{235} fissioned by 15.0-Mev neutrons in order to determine the effects of specimen thickness on the retarded neutron yield. Yields from specimens of U^{238}, Th^{232}, and U^{235}, 35 mm in diameter and 9, 10, and 8 mm in thickness, were also measured. (R.V.J.)

1752

ON NUCLEON INTERACTIONS LEADING TO THE APPEARANCE OF SUPERFLUID STATE OF ATOMIC NUCLEUS. V. G. Solov'ev (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 35, 823-5(1958). (In Russian)

The appearance of superfluidity in medium and heavy nuclei, which is energetically a more favorable state than the total disintegration state of the Fermi gas (normal state), was studied using Bogolyubov's variation principle (generalization of the Fock method and the mathematical methods developed in the theory of superconductivity). It is shown that the superfluid state is energetically more favorable and is separated from the normal state by a slit. The interactions of protons with equal or counter projection moments on the same shell lead to the appearance of the superfluid state. (R.V.J.)

Theory

1753 AFOSR-TN-57-389

Purdue Univ., Lafayette, Ind.

POLARIZATION MEASUREMENTS AND THE UNIVER-

SAL FERMI INTERACTION. D. C. Peaslee. June 27, 1957. 14p. Contract AF18(600)-1579. (AD-132464).

Two main possibilities are considered. If the two-component neutrino with lepton conservation is adopted, the UFI must involve predominantly (VT) for nuclear β-decay, and there is a discrepancy of a factor of 2 in the magnitude of the coupling constant C_v as compared with μ-e decay; the coefficient C_t is arbitrary, and $C_s = C_P$ is small. The slight preliminary evidence available on $K_{\mu 3}$ and K_{e3} does not favor a predominant V term. If the two-component neutrino with lepton conservation is abandoned, one can write an interaction of the (STP) form that fits all present polarization measurements. This interaction can be definitely excluded in μ-e decay only by an absolute measurement of the μ polarization direction or by observing two separate electron polarization terms in the μ-e process. (A.C.)

1754 NYO-7118

General Atomic Div., General Dynamics Corp., San Diego, Calif. and Carnegie Inst. of Tech., Pittsburgh.

NON-LINEAR RESONANCES IN TWO-DIMENSIONAL DYNAMICAL SYSTEMS. Felix T. Adler and Donald Edward Parks. June 2, 1958. 168p. Contract AT(30-1)-882. $25.80(ph OTS); $7.80(mf OTS).

A general method is developed for the treatment of two-dimensional oscillations described by a Hamiltonian, $H(q, p; t) = H(q, p; t + \tau)$. This method leads to an explicit construction of two independent invariants, by means of which the motion of the system can be described simply in a two-dimensional phase space. Equations of motion for the amplitudes are obtained by means of the invariants. These equations provide a means of estimating the maximum amplitudes resulting during the motion starting from a given set of initial conditions. The rate of build up of amplitude and, therefore, the time required for energy transfer between the degrees of freedom of the system is also obtained. By generalizing the methods developed for Hamiltonian systems, non-canonical systems are treated and the time dependence of the amplitude of small oscillations in a non-linear system with variable damping is determined. These applications, e.g., to the Van der Pol equations, may be of considerable interest in many engineering problems. (auth)

1755 SCL-T-201

THERMODYNAMICS OF THE ELECTRON GAS. (K Termodinamike Elektronnogo Gaza). Yu. B. Rumer. Translated by Marcel I. Weinreich (Sandia Corp.) from Zhur. Eksptl'. i Teoret. Fiz. 19, 757-9(1949). 5p.

In a previous study, it was shown that, in the case of an ideal electronic gas, it is convenient to represent the thermodynamic potential Omega as a function of the chemical potential Zeta and of the temperature T in the form of the contour integral. By rewriting the integral and changing the order of integration, a double equation is obtained wherein it may be stated that the dependence of the potential Omega on Zeta at a temperature T is unequivocally determined by the dependence of Omega on Zeta at absolute zero. (W.D.M.)

1756

RELATIVISTIC WAVE EQUATIONS FOR SPIN-2 PARTICLES WITH UNIQUE MASS. O. Brulin and S. Hjalmars (Univ. of Stockholm and Royal Inst. of Tech., Stockholm). Arkiv Fysik 14, 49-60(1958).

The irreducible spin-2 case is investigated in some detail, where the 14 components of the wave function ψ consist of the components of a symmetric tensor of second rank and of a vector. Explicit representation of the 14-row matrices β_k and the metric form β are deduced by means of the subspace method of Klein. By means of this representation the most general form of the mass term is proved to be an arbitrary linear combination of three commuting projection operators of sum 1. It is proved that all components of ψ satisfy the same fourth order differential equation, showing that the two rest mass values can be given arbitrary ratio. All components of ψ then satisfy the same Klein-Gordon equation, showing that in this case the particle has unique mass. (W.D.M.)

1757

EQUALITY OF THE SPIN TEMPERATURE AND THERMODYNAMICAL TEMPERATURE. Anatole Abragam and Warren Proctor. Compt. rend. 245, 1048-50(1957) Sept. 23.

An experiment was made which proved the equality of the thermodynamic temperature and spin temperature, as they are defined in certain experiments of nuclear resonance. (auth)

1758

A METHOD FOR THE STUDY OF THE VALIDITY OF THE TOMONAGA INTERMEDIATE COUPLING METHOD. Jacques Mandelbrojt. Compt. rend. 247, 915-17 (1958) Sept. 29. (In French)

The validity of the Tomonaga approximation is studied by means of a Weinstein inequality. In the simple case of the neutral scalar meson theory, it is found that the Tomonaga approximation gives an exact solution. In the more realistic case, the Weinstein inequality given an evaluation of $E - E_T$ and shows that in the symmetric scalar case, $(E - E_T)/E \rightarrow 0$ for $g \rightarrow \infty$. (tr-auth)

1759

ON THE SCHROEDINGER OPERATION SPECTRUM. G. M. Zhislin (Lobachevskii, Gor'kii State Univ.). Doklady Akad. Nauk. 122, 331-4(1958) Sept. 21. (In Russian)

The Schroedinger operator spectrum for atoms and ions, with consideration for the motion of their nuclei, is reduced to the aspect $a_0 < 0$. The existence of finite spectra was determined. (R.V.J.)

1760

ON THE EQUILIBRIUM FUNCTION OF ANGULAR DISTRIBUTION OF PARTICLES IN CASCADE SHOWERS. I. P. Ivanenko (Lomonosov, Moscow State Univ.). Doklady Akad. Nauk. 122, 367-70(1958) Sept. 21. (In Russian)

Formulas for the angular distribution of particles in a shower maximum, considering ionization losses in the approximation of small and large angles, were derived for multiple scattering approximation. (R.V.J.)

1761

CALCULATIONS OF STABILIZED FIELD PRODUCED BY POLARIZATION OF ELONGATED AND COMPRESSE SPHEROID SHAPED BODIES. L. A. Gel'bukh. Izvest. Akad. Nauk S.S.S.R. Ser. Geofiz. No. 10, 1192-1201(1958) Oct. (In Russian)

The relations were derived for the potential and electric moment induced by polarization of elongated and compressed spheroid-shaped bodies. (R.V.J.)

1762

A CLASSICAL REPRESENTATION OF THE WEYSSENHOFF CORPUSCLE. F. Halbwachs. J. phys. radium 19, 42S-3S(1958) Aug.-Sept. (In French)

1763

TWO GROUP CALCULATION OF PROMPT NEUTRON LIFETIME. Wm. Howard Arnold, Jr. Nuclear Sci. and Eng. 4, 598-600(1958) Oct.

A simple formula for the calculation of the prompt neutron lifetime is derived from two group reactor theory. It is pointed out that the group neutron velocity (ν) which appears in the equations should be calculated by inverting the average of $1/\nu$. (auth)

1764

INTEGRAL REPRESENTATION OF A DOUBLE COMMUTATOR. Freeman J. Dyson (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 111, 1717-18(1958) Sept. 15.

An integral representation is found for the vacuum expectation value of a double commutator. The problem of incorporating the Jacobi identity into such a representation remains unsolved. (auth)

1765

PROPOSED BOUNDARY CONDITION POTENTIAL FOR THE TWO-NUCLEON PROBLEM. S. A. Moszkowski and B. L. Scott (Univ. of California, Los Angeles). Phys. Rev. Letters 1, 298-300(1958) Oct. 15.

The proposed approach to the nuclear problem is to use as a starting point a somewhat different two-body potential which should adequately describe nucleon-nucleon scattering data and for which the Brueckner technique can be applied somewhat more readily. A brief description of this potential and a preliminary account of its application to the two-nucleon problem are given. (W.D.M.)

1766

EXCLUSION PRINCIPLE AND PHENOMENOLOGICAL OPTICAL-MODEL POTENTIALS. Lee M. Frantz, Robert L. Mills, Roger G. Newton, and Andrew M. Sessler (Ohio State Univ., Columbus). Phys. Rev. Letters 1, 340-1(1958) Nov. 1.

In recent years the elastic scattering of particles by a nucleus has been successfully analyzed in terms of a simple complex-potential model. In such calculations the exclusion principle has been ignored, although for not too energetic bombarding nucleons the effect can be considerable. A modification of the optical model is proposed which takes into account the effect of the exclusion principle within the framework of a single-particle description of the many-body problem. (W.D.M.)

1767

NEW METHODS IN THEORETICAL PHYSICS. D. N. Zubarev and B. V. Medvedev (Steklov Inst. of Math, Moscow). Priroda No. 9, 51-7(1958) Sept. (In Russian)

A review is given of new mathematical methods in theoretical physics and N. N. Bogolyubov's contributions to that field. (R.V.J.)

1768

EIGENPHASESHIFTS IN TERMS OF WIGNER'S NUCLEAR REACTION THEORY. L. C. Biedenharn (Univ. of Manchester, Eng.) and H. B. Willard (Oak Ridge National Lab., Tenn.). Proc. Phys. Soc. (London) 72, 874-9(1958) Nov.

Eigenphaseshifts and eigenvectors of nuclear scattering are constructed from the Wigner many level approximation, after separation of the potential scattering. The two level case is discussed in detail, and a single approximation based upon the eigenphaseshift formalism is suggested. (auth)

1769

THE EXPONENTIAL APPROXIMATION IN PARTICLE DECAY. G. Höhler (Univ. of Munich). Z. Physik 152, 546-65(1958). (In German)

The approximation leading to the exponential time dependence was investigated in a simple model of the two-particle decay. The Weisskopf-Wigner method is first used and then the exact solution of the initial value problem according to the Heitler damping theory. The exponential law follows as a result of a pole in the analytical continuation of the expectancy value of the resolvent. For the asymtotic behavior for long time periods, the branching point at the beginning of the continuous spectrum was determined. It leads, in general, to a power law. In the decay with weak interactions measurable effects are not expected. Deviations in strong interactions depend on the more accurate form of the coupling. Its discussion requires further investigations on the ideas of the short-lived unstable particles. (tr-auth)

1770

ON THE WAVE FUNCTIONS OF MANY-ELECTRON SYSTEMS. V. I. Perel (Leningrad State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 685-90(1958). (In Russian)

A general form of the wave function was derived which is the eigenfunction of S^2 and S_z and satisfies the Pauli principle. An expression is given for the Schroedinger wave function of a system which consists of single-electron functions. (tr-auth)

1771

RADIATIVE CORRECTIONS TO BREMSSTRAHLUNG. P. I. Fomin (Kharkov State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 707-18(1958). (In Russian)

Radiative corrections to the differential cross section for bremsstrahlung are computed with aid of the mass operator method. A general formula is obtained and some limiting cases are considered. (tr-auth)

1772

CONTRIBUTION TO THE THEORY OF WEAK INTERACTIONS. II. Yu. A. Golfand (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 726-30(1958). (In Russian)

A scheme is proposed in which the non-hermitian weak interaction Hamiltonian H_w is a constituent part of the hermitian total Hamiltonian operating in "doubled" Gilbert space. (tr-auth)

1773

DE HAAS–VAN ALPHEN EFFECT IN PULSED MAGNETIC FIELDS. A. M. Kosevich (Inst. of Physics and Technology, Academy of Sciences Ukrainian SSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 738-41(1958). (In Russian)

Quasiclassical quantization formulas were obtained for the motion of an electron of a metal located in a magnetic field whose gradient is perpendicular to the direction of the field. The de Haas–van Alphen effect in a pulsed magnetic field is analyzed from the standpoint of the possibility of applying it for investigation of the Fermi surface of the electron gas in a metal. (tr-auth)

1774

ON SCATTERING OF CLOUDED PARTICLES IN QUANTUM FIELD THEORY. Yu. V. Novozhilov (Leningrad State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 742-9 (1958). (In Russian)

A scattering theory is considered in which the virtual "clouds" around the particles are always taken into account exactly. The theory is based on the representation of basis functionals in the form of products of single particle functionals. In the absence of vacuum polarization the equations for the matrix elements are automatically renormalized and the matrix elements can be expressed in terms of the single-nucleon matrix elements. (tr-auth)

1775

THE WAVE FRONT VELOCITY IN ELECTRODYNAMICS WITH HIGH DERIVATIVES. L. G. Yakovlev (Uzbek State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 782-3 (1958). (In Russian)

It is shown that for general cases in electrodynamics with high derivatives, as in non-linear electrodynamics, there are four propagation velocities differing from the light velocity in vacuum. (R.V.J.)

1776

ON THE PROBLEM OF WELL-DEFINED PHASE ANALYSIS. L. G. Lastavenko (Joint Inst. of Nuclear Research). Zhur. Eksptl'. i Teoret. Fiz. 35, 785-7 (1958). (In Russian)

Transformations of the scattering matrix without changing differential cross sections were previously published for the case of particle collision with 0 and ½ spin. An analogy is offered for such transformation for the case of particle collision with arbitrary spin. (R.V.J.)

1777

EQUATIONS OF MOTION FOR SYSTEMS WITH TWO-TYPE SPIN INTERACTIONS. G. V. Skrotskii (Ural Polytechnic Inst.). Zhur. Eksptl'. i Teoret. Fiz. 35, 793-4(1958). (In Russian)

Derivations of thermodynamic equations are presented for two-spin systems with spin-spin and spin-matrix relaxation, describing the behavior in arbitrary oriented constant and varying fields. (R.V.J.)

1778

SCATTERING OF PARTICLES WITH 3/2 SPIN IN COULOMB FIELD. A. A. Komar (Lebedev Inst. of Physics, Academy of Sciences, USSR). Zhur. Eksptl'. i Teoret. Fiz. 35, 806-7(1958). (In Russian)

Scattering of particles with $^3/_2$ spin in a nuclear Coulomb field is investigated. It is indicated that for 1 and $^3/_2$ spins the corrections increase with the energy; this is especially obvious for the case of $^3/_2$ spin. (R.V.J.)

1779

CIRCULAR POLARIZATION OF INTERNAL γ BREMSSTRAHLUNG IN β DECAY AND THE INVARIANCE IN TIME INVERSION. R. Yu. Volkovyskii (Leningrad State Univ.). Zhur. Eksptl'. i Teoret. Fiz. 35, 811-12(1958). (In Russian)

The bremsstrahlung effect in β decay was theoretically investigated in relation to temporary parity conservation. (R.V.J.)

RADIATION EFFECTS ON MATERIALS

1780 ANL-5676

Argonne National Lab., Lemont, Ill.

PRELIMINARY ANALYSIS OF FISSION-INDUCED DIMENSIONAL CHANGES IN SINGLE CRYSTALS OF URANIUM. S. H. Paine and J. H. Kittel. Oct. 1958. 18p. Contract W-31-109-eng-38. $0.75(OTS).

Irradiations of uranium true single crystals and lineage crystals are described. Analysis of the dimensional and shape changes results in the crystallographic deformation rates: $G_{[100]} = -420 \pm 20$, $G_{[010]} = 420 \pm 20$, and $G_{[001]} = 0 \pm 20$, where G is the logarithmic increment divided by the fission ratio. The lineage crystals elongated in the [010] direction at appreciably higher rates than the single crystals. (auth)

1781 BMI-1292

Battelle Memorial Inst., Columbus, Ohio.

DESIGN FEATURES OF CAPSULES FOR HIGH-TEMPERATURE IRRADIATIONS. John H. Stang, William H. Goldthwaite, and Bruce W. Dunnington. Sept. 22, 1958. 18p. Contract W-7405-eng-92. $0.75 (OTS).

An analysis was made of the problems of control and measurement of specimen temperature and heat generation in a NaK-filled capsule containing a fuel specimen. A specific problem is used in this report to demonstrate the large uncertainties normally encountered even in capsules containing thermocouples. This analysis indicates that an improvement by a factor of more than three (i.e., from an uncertainty of ± 70°F to ± 20°F in the example used) may be obtained by use of a differential-thermocouple heat-flow meter and by use of a precision thermocouple-placement clip. Since the irradiation damage suffered by fuel specimens is sensitive to small changes in temperature and burnup, improvements in precision in irradiation testing are of great importance in fuel studies. If the indicated improvement of precision by a factor of three is actually obtained when capsules of this design are irradiated, the experimenter will be able to draw much more reliable conclusions from a given testing program. (auth)

1782 CF-58-10-30

Oak Ridge National Lab., Tenn.

PHASE III—FOREIGN REACTOR—FUEL SAMPLE IRRADIATION OF U_3O_8—Al DISPERSIONS. IRRADIATION REQUEST ORNL-MTR-35. C. F. Leitten and W. J. Kucera. Oct. 18, 1958. 14p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

The integrity and suitability of 35 vol. % U_3O_8 dispersion in Al as a fuel for foreign reactors were determined. The fuel was exposed in the beryllium reflector of the MTR. Sample fabrication and conditions of exposure are described, and the results are tabulated. (J.R.D.)

1783 CRMet-801

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

THE EFFECT OF QUENCHING AND NEUTRON IRRADIATION ON INTERNAL FRICTION OF A SUPER PURITY Al-5% Mg ALLOY. W. G. Nilson. Sept. 1958. 34p. (AECL-701). ?0.50(AECL).

The experimental information for the low-frequency internal friction peak near 150°C in an aluminum—5% magnesium alloy indicates that it is likely due to stress-induced local ordering of the solute atoms. Its movement to lower temperatures after either quenching or neutron irradiation, corresponding to a reduction in relaxation time for the damping process, is compatible with the idea that the magnesium atoms act as traps for the vacancies produced by these treatments. The annealing out of the damping effects produced by quenching and irradiation occurred around 100°C. This corresponds to the recovery of quenched-in excess electrical resistivity attributed to the release of the defects from solute atoms. The activation energy of 27.7 kcal/mole determined for the stable peak was in agreement with internal friction results of others. This is slightly lower than the activation energy for diffusion of magnesium in aluminum determined at high temperatures. A high damping observed near room temperature in slowly cooled material may be due to solute segregation, e.g., some change in structure in the very early stages of precipitation. (auth)

1784 IDO-16475

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

RADIATION DAMAGE STUDIES PROGRAM. ETR LOOP MATERIALS PROGRESS REPORT III. H. T. Watanabe. Sept. 15, 1958. 68p. Contract AT(10-1)-205. $1.75(OTS).

The results are summarized of physical tests on irradiated materials that have some attraction for use in high-pressure equipment intended for operations in the reactor. The materials selected for test were 16-1 Croloy, Hastelloy-X, Inconel-702, Inconel-X (single-aged), Inconel-X (double-aged), K-Monel, 410 stainless steel, 414 stainless steel, AM-350 stainless steel and Zircaloy-2. In progress reports published to date on effects of neutron irradiation on these materials, it is conceded that most alloys will increase in strength and brittleness with increase in irradiation time. This paper will present the latest observations of these irradiation effects. (For preceding period see IDO-16409.) (auth)

1785 NP-6984

CORRELATED COLLISIONS IN A DISPLACEMENT SPIKE. G. Leibfried. [1957]. 27p.

Structural damage in metals irradiated with high-energy particles is caused by collisions with the atoms of the crystal lattice. A quantitative theory of the influence of correlated collisions in face-centered-cubic metals is presented. (W.L.H.)

1786 NP-6994

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

MONTHLY ACCESSION LIST NO. 16 [ON RADIATION EFFECTS DATA]. Oct. 15, 1958. 26p. Project No. 2133. Contract AF33(616)-5171.

1787 NP-7048

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

MONTHLY ACCESSION LIST NO. 17 [ON RADIATION EFFECTS DATA]. Nov. 15, 1958. 25p. Project No. 2133. Contract AF33(616)-5171.

1788 WAPD-PWR-PMM-1103

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

EXPERIMENTS WAPD 14—PA AND PB. L. J. Jones. Mar. 11, 1957. 26p. $4.80(ph OTS); $2.70(mf OTS).

Specifications are given for experiments designed to determine the effects of radiation on the dimensional stability, mechanical characteristics, fission gas release, and microstructure of ceramic fuel materials in a brazed plate fuel element geometry. Materials to be tested are 8.05 wt. % U^{235} O$_2$—UO$_2$ and 21 wt. % U^{235} O$_2$—Al$_2$O$_3$. Experiment 14-PA is scheduled for two MTR cycles yielding 23% U^{235} burnup; experiment 14-PB is for nine cycles yielding a U^{235} burnup of 62%. Specimens will be Zircaloy-2 clad plates contained in NaK filled 2s aluminum capsules. (D.E.B.)

1789

EFFECT OF CRYSTALLINITY ON RADIATION EFFECTS IN POLYETHYLENE. E. Charlesby, E. Von Arnim, and L. Callaghan (Tube Investments Research Labs., Hinxton Hall, Cambridge, Eng.). Intern. J. Appl. Radiation and Isotopes 3, 226-31(1958) Aug.

The effect of degree of crystallinity on the irradiation induced crosslinking of polyethylene has been studied for types of polyethylene of low and high densities and various degrees of branching. Measurements of solubility indicate a lower gelling dose for low density, low crystallinity polyethylene while swelling and modulus determination give the same crosslinking density for four different types of polyethylene. It is concluded that the G value for crosslinking does not differ considerably in the amorphous or crystalline regions and the lower gel dose for the low density, highly branched polymer is due to its higher weight average molecular weight. (auth)

1790

VARIATION OF GRAPHITE DIFFUSION LENGTH WITH TEMPERATURE. R. C. Lloyd, E. D. Clayton, and C. R. Richey (General Electric Co., Richland, Wash.). Nuclear Sci. and Eng. 4, 690-7(1958) Nov.

The graphite diffusion length was measured as a function of temperature in a 101-inch cube of graphite. A water-cooled BF$_3$ counter was used as the neutron flux detector, with additional measurements being made with gold and indium foils. The steady state neutron flux was furnished by means of four ½-gram, Ra-Be neutron sources. Measurements were taken over a range of temperature from 22 to 600°C at intervals of about 50°C. The variation of diffusion length with temperature change is in good agreement with the calculated variation assuming a $1/v$ cross section for graphite and a constant transport mean free path. (auth)

1791

EFFECTS OF GAMMA RADIATION ON ORGANIC FLUIDS AND LUBRICANTS. William L. R. Rice (Wright-Patterson Air Force Base, Dayton, Ohio). Nucleonics 16, No. 10, 112-13(1958) Oct.

Irradiations of static samples of a refined petroleum oil such as used in aircraft reciprocating engines, a diester-based aircraft-instrument lubricating oil, a polymer-thickened silicate ester high-temperature hydraulic fluid, the alkyl aromatic fluid monoisopropylbiphenyl, and a paraffinic kerosene were conducted at ambient temperatures in the spent-fuel-element canal of the Materials Testing Reactor and at Hanford. The effects of the gamma radiation on the viscosity, flash point, gas evolution, and evaporation are plotted as a function of the gamma dosage. (J.S.R.)

1792

POLYMER DEGRADATION. WIDE-RANGE DOSIMETER. Paul Y. Feng (Armour Research Foundation, Chicago). Nucleonics 16, No. 10, 114(1958) Oct.

Polymer degradation can be the basis of a good wide-range dosimeter. Theory suggests that the extent of degradation can be related directly to dose and other parameters such as initial molecular weight and concentration of solution. There is some experimental confirmation of this hypothesis. It is expected that a polymer dosimeter would be useful for radiation doses from 10^2 to 10^8 rads. (J.S.R.)

1793

V-TYPE CENTER RESONANCE OF NEUTRON-IRRADIATED LiF AT ROOM TEMPERATURE. Y. W. Kim, R. Kaplan, and P. J. Bray (Brown Univ., Providence). Phys. Rev. 111, 1468-9(1958) Sept. 15.

A V-type center similar to one described by Känzig and co-workers was found in LiF single crystals neutron-irradiated at room temperature. Analysis of the s and p admixture in the electron wave function, using the Hamiltonian of Woodruff and Känzig, is made from the angular dependence of the electron-spin resonance spectrum. (auth)

1794

EFFECT OF MONOENERGETIC FAST NEUTRONS ON n-TYPE GERMANIUM. S. L. Ruby, F. D. Schupp, and E. D. Wolley (Westinghouse Electric Corp., East Pittsburgh). Phys. Rev. 111, 1493-6(1958) Sept. 15.

The density of vacancy-interstitial pairs produced per unit of fast-neutron flux on n-type germanium was measured experimentally using monoenergetic neutrons. The changes in resistivity and Hall coefficient were determined as a function of neutron flux and energy for n-type germanium having impurity concentrations of about 2 × 10^{12} cm^{-3}. Both the irradiation and electrical measurements were made at about 77°K. Neutron energies in the experiment were 4.8, 3.2, and 1.7 Mev from the $H^2(d,n)He^3$ reaction and the observed changes in resistivity and Hall coefficients indicate charge carrier removal rates per unit of neutron flux, $-dn/d\phi$, of 12, 12, and 21, respectively. Not only do the results appear much lower than the value of 160 calculated by current models, but they are less than would be estimated by extrapolating the results obtained with reactor neutron irradiations. (auth)

1795

NEUTRON-BOMBARDMENT DAMAGE IN SILICON. G. K. Wertheim (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. 111, 1500-5(1958) Sept. 15.

Neutron-bombardment damage in silicon is compared to electron-bombardment effects which have been previously analyzed. A discrete energy level 0.27 ev above the valence band previously ascribed to the acceptor member of a defect pair having a separation greater than 50 A, is found to be produced by both neutrons and electrons. A spectrum of energy levels running from 0.16 ev below the conduction band toward the middle of the gap is ascribed to a defect pair with variable spacing, and related to the discrete level 0.16 ev below the conduction band which was found previously in electron-bombardment of silicon, and there ascribed to a close-spaced pair of defects. Lifetime effects are found to be dominated by levels near the middle of the energy gap, which may be related to the above spectrum. A very rapid decrease in mobility at low temperature is ascribed to bombardment-induced inhomogeneities. (auth)

1796

DENSITY OF NEUTRON-IRRADIATED LITHIUM FLUORIDE CRYSTALS. J. Spaepen (Studiecentrum voor Kernenergie, Mol, Belgium). Phys. Rev. Letters 1, 281-2(1958) Oct. 15.

The density of lithium fluoride crystals irradiated in the 10^{18} range in BR1 was measured by flotation of the samples in suitable mixtures of bromoform, hexanol, and pentanol. By comparison with standard floats of fused silica, an accuracy of 0.001% was readily attained. A U-shaped flotation chamber was used, one tube containing the crystals and the other the standard float. (W.D.M.)

1797

INDEX OF REFRACTION OF NEUTRON IRRADIATED DIAMOND. J. Pelsmaekers and J. Schepers (Studiecentrum voor Karnenergie, Mol, Belgium). Physica 24, 838(1958) Oct.

The index of refraction was measured by the minimum deviation method in a 200 mg diamond prism of about 43° at various neutron doses up to 1.2 × 10^{17} n/cm^2, at which level the diamond turned green and was insufficiently transparent to continue study. The wavelength used was 5893 A ± 0.0001. No change in index was noted even after 30-minute anneals at 400 and 750°C. (T. R.H.)

RADIOACTIVE WASTE

1798 BNL-3867

Brookhaven National Lab., Upton, N. Y.

WASTE PROCESSING STUDIES MONTHLY PROGRESS REPORT [FOR] MARCH 1958. M. Steinberg. Apr. 9, 1958. 3p. $1.80(ph OTS); $1.80(mf OTS).

Construction of the experimental unit for studying the thermal decomposition of nitrous oxide is nearing completion. The Orsat method of gas analysis, using catalytic reduction of N_2O, was satisfactorily developed for gas mixtures containing NO, N_2O, H_2, O_2, and N_2. Capacity measurements of molecular sieves for adsorption of Kr and N_2 at pressures as high as 150 psig and at temperatures as low as −184°C are under way. (W.L.H.)

1799

RADIOACTIVE WASTE DISPOSAL IN THE ABYSSAL DEPTH OF THE OCEAN. V. G. Bogorov and E. M. Kreps. Priroda No. 9, 45-50(1958) Sept. (In Russian)

Analysis of the ocean abyssal depth contour, hydrological and hydrochemical analysis, and studies of ocean bottom depositions, life organisms, and water circulation show that water intermixing is relatively rapid and that buried soluble waste would be brought to the surface layers and eventually into contact with plants and animals. Consequently, waste disposal in the abyssal depth of the ocean presents a definite future threat to humanity. (R.V.J.)

REACTORS

General

1800 AECU-3850

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

STUDIES OF REACTOR CONTAINMENT. Combined Monthly Progress and Financial Status Report No. 17. T. A. Zaker. Oct. 3, 1958. 6p. ARF Project D132. Contract AT(11-1)-528. $1.80(ph OTS); $1.80(mf OTS).

Progress of technical effort is summarized for each of the eight tasks of the program. The statement of financial status for the program as of Sept. 1, 1958, is given. (For preceding period see AECU-3820.) (W.D.M.)

1801 AERE-R/R-2399(Rev.)

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EXPERIMENTAL BASIS OF LATTICE CALCULATIONS. PART I. A THIRD REVISION OF THE

METHOD. C. G. Campbell and J. L. Symonds. Sept. 1958. 35p. (NPCC/RPWP/P-153). $0.70(BIS).

The two group neutron diffusion equations are developed with one equation referring strictly to thermal neutron events only, and the other to epithermal events. Particular attention is paid to averaging the diffusion parameters correctly over the appropriate region of the neutron velocity spectrum adopted. The effects of epithermal neutron absorption upon the slowing down area are taken into account, and a method for correlating the experimental measurements of buckling, intracell neutron distributions, neutron energy spectrum, fast fission factor, and conversion ratio is proposed. (auth)

1802 AERE-T/M-166

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

AN INVESTIGATION INTO THE CAUSES OF A DISCREPANCY IN THE THEORETICALLY PREDICTED K_∞ FOR ENRICHED URANIUM HEAVY WATER LATTICES. K. T. Spinney. June 1958. 24p.

The discrepancy between theoretical and experimental values of the reactivity of enriched uranium—heavy water lattices was investigated. A description of the experimental apparatus, known as DIMPLE, is given, along with a discussion of the procedure. It was concluded that all of the discrepancy could not be accounted for; however, some reasons are given, such as incomplete allowance for the inhomogeneity of the core resulting in an underestimate of the leakage. (J.R.D.)

1803 APEX-414

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

NUCLEAR TEST GAGE SAFETY EXPERIMENT. J. N. Renaker and V. J. Stratton. Feb. 1958. 15p. Contract AF33(038)-21102 and AT(11-1)-171. $0.75(OTS).

Final design of the Nuclear Test Gage (NTG) was established on the basis of the experimental data and the data analysis obtained from investigating a mockup of the NTG core in the General Electric flexible critical experiment facility. Results of the studies show that the Nuclear Test Gage, as presently conceived, is extremely sensitive to alterations of the central void, i.e., slight changes in the makeup of the central void effect rather large changes in the multiplication of the assembly. (auth)

1804 CF-58-4-93(2nd Issue)

Oak Ridge National Lab., Tenn.

REMOTE MAINTENANCE EXPERIMENTAL WORK ON A REACTOR SYSTEM PUMP. W. B. McDonald, C. K. McGlothlan, and E. Storto. July 25, 1958. 35p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

An experimentally determined evaluation of standard-remote-handling equipment applied to the problems associated with remote maintenance of a typical reactor system component is presented. It is concluded that commercially available equipment can be used and that a good technician can rapidly learn the use of manipulators required in remote maintenance. The use of closed circuit television in maintenance is possible; however, further development of radiation-resistant equipment is required. (J.R.D.)

1805 CF-58-9-1

Oak Ridge National Lab., Tenn.

DESIGN AND ANALYSIS OF A MECHANICAL TRANSITION JOINT BETWEEN DISSIMILAR MATERIALS—APPLICATION TO HRT. R. D. Cheverton and T. H. Mauney. Sept. 15, 1958. 64p. Contract [W-7405-eng-26]. $10.80(ph OTS); $3.90(mf OTS).

The design and analysis of a mechanical transition joint between materials having different thermal coefficients of expansion are discussed. The analytical treatment is based primarily on the analysis of short cylinders. The specific design for the Zircaloy-2-stainless steel core vessel joint in the HRT is discussed in detail. Brief summaries of preliminary designs and test results are included along with results obtained from the tests performed on the final design for the HRT. (auth)

1806 HW-47574(Del.)

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

PRELIMINARY ANALYSIS OF THE PLUTONIUM RECYCLE PROGRAM REACTOR SHIELD. D. E. Wood and John L. Weeks, Jr. Dec. 26, 1956. Decl. with deletions Oct. 13, 1958. 11p. Contract [W-31-109-eng-52]. $3.30(ph OTS); $2.40(mf OTS).

The bases and methods of calculation used in the preliminary analysis of the PRPR shielding are presented. The various shield thicknesses tentatively recommended are listed. (A.C.)

1807 HW-57636 A2

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

DIVISION OF REACTOR DEVELOPMENT PROGRAMS MONTHLY REPORT [FOR] SEPTEMBER 1958. L. H. McEwen, comp. Oct. 15, 1958. 26p. Contract W-31-109-Eng-52. $4.80(ph OTS); $2.70(mf OTS).

The macroscopic fission cross sections for the PuO_2-UO_2 mixed crystal oxide capsules were determined. The sinterability of UO_2 and UO_2-PuO_2 was compared. The extrusion of Al—U alloy billets is described. In the process of Pu recovery from irradiated Al—Pu alloys by molten bismuth and silicon addition, experiments are being made to determine whether the Pu concentration in the resulting Al—Si alloy can be made higher than the Pu concentration in the starting Al alloy. Extruded aluminum rods were successfully loaded into Zircaloy tubes. The post-irradiation of UO_2 canned in Zircaloy-3 is continuing, and additional information is reported. Corrosion tests of steel shot in inhibited, softened water were completed. An ammonium fluoride—hydrogen peroxide—acetic acid solution at pH 5 is being evaluated as a pretreatment etch for Zircaloy-2. Values of k_∞ and f were calculated from the experimental PCTR data taken with 19-rod UO_2 clusters in a 9-inch D_2O lattice. Swelling of uranium during irradiation was studied. Gas-graphite reactions were studied for the gas-cooled central station power reactor program. (For preceding period see HW-57225-A2.) (W.D.M.)

1808 IDO-10034

Idaho Operations Office, AEC.

ESTIMATED UNIT COST OF COBALT FROM A COBALT-60 PRODUCTION REACTOR. Oct. 20, 1957. 7p. $0.50(OTS).

The unit cost of cobalt is computed for two modes of operation. In the first mode, the only service to be provided the customer is that of irradiation. The customer supplies canned cobalt ready for irradiation and is shipped the irradiated units in the same container. The estimated average unit cost for this mode of operation is $0.94 per curie. In the second mode of operation, an integrated service is provided to produce marketable cobalt, which includes cost associated with the purchase of cobalt, its canning and decanning, the construction of hot cell facilities, and the furnishing of shipping containers. In this mode of operation, the estimated average unit cost is $1.02 per curie. (auth)

1809 IDO-16421

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

COBALT-60 PRODUCTION REACTOR. June 7, 1957. 99p. Contract AT(10-1)-205. $2.75(OTS).

An MTR-type reactor employing highly enriched uranium-235 was selected, thereby avoiding major development work. However, a major redesign of the reactor core was made in order to obtain greater neutron leakage and thereby greater isotope production per unit of heat energy generated. In addition, an improved arrangement was developed for the reactor and canal. The reactor is located in a well at the end of the working canal, and the reactor pit joins the canal via an 18-inch bulkhead. The estimated annual cobalt-60 production is 3,200,000 curies. A basic staff of about 50 people is required. The annual operating cost excluding depreciation is $2,200,000 with the customers supplying canned cobalt ready for irradiation and receiving the irradiated units back in the same containers. If an integrated operation is desired to produce marketable cobalt-60 source, hot cell facilities and shipping containers must be provided. The incremental operating costs, including cost of cobalt and its canning and decanning, but excluding depreciation, total approximately $170,000 per year. All capital costs for the Cobalt-60 Production Reactor and the estimated unit production costs for cobalt-60 are presented in report IDO-10034. (auth)

1810 IDO-16453

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

SOURCE STRENGTH INFORMATION FOR SHIELDING AND STACK EFFLUENT CALCULATIONS. A STANDARD PRACTICES GUIDE. L. H. Jones. Oct. 3, 1958. 23p. Contract AT(10-1)-205. $0.75(OTS).

Curves and methods are presented for determining gross fission product gamma energy in Mev/sec-watt, gross fission product beta decay in curies/sec-watt, delayed uranium fission neutrons in neutrons/sec-watt and N^{16} and N^{17} decay in photons/sec-cc of water. The data cover infinite irradiation and one second to several days decay. Source of the data used and methods of calculation are presented for each curve. (auth)

1811 KAPL-M-GOM-3

Knolls Atomic Power Lab., Schenectady, N. Y.

A GENERALIZED EQUATION FOR DETERMINING FUEL ELEMENT TIME RESPONSES WHERE COOLANT TEMPERATURE REMAINS CONSTANT. Gerhard O. Mueller. Oct. 14, 1958. 20p. Contract W-31-109-Eng-52. $3.30(ph OTS); $2.40(mf OTS).

A generalized expression for a reactor fuel element time response was developed. The resulting expression, in the form of an infinite series, allows the variation of fuel (meat) thickness, clad thickness, and film resistance to determine the relative effect on the over-all response time. An example of the use of this expression is included, and the results are presented in graphical form. (auth)

1812 LA-1610

Los Alamos Scientific Lab., N. Mex.

KINETICS OF THE LOS ALAMOS POWER REACTOR EXPERIMENT (LAPRE). John C. Allred and David S. Carter. Dec. 1953. Decl. Oct. 8, 1956. 61p. Contract W-7405-eng-36. $10.80(ph OTS); $3.90(mf OTS).

A theoretical study of the kinetics of a model of the Los Alamos Power Reactor Experiment (LAPRE) was made through integration of the dynamic equations with the IBM 701 computer. The stability is investigated under various conditions of power demand, rod-induced reactivity changes, and other conditions especially applicable to LAPRE. The results are given in graphical form, along with conclusions as to appropriate conditions of operation. (auth)

1813 MND-RP-558-17

Martin Co. Nuclear Div., Baltimore.

CONCEPTUAL DESIGN FOR A PROCESS STEAM REACTOR. C. Eicheldinger, G. Zindler, and C. Deese. [June 1958]. 15p.

Presented before American Nuclear Society Annual Meeting, Los Angeles, California, June 2-5, 1958.

A conceptual design is presented for a reactor system to produce process steam. Typical plant operating characteristics were chosen as a basis for the design. Emphasis was placed on the primary loop configuration and components and, in particular, on the reactor. Having chosen a basis system concept, design parameters were chosen by compromising nuclear, heat transfer, and materials requirements as well as economic considerations. Of the two systems considered, boiling water and pressurized water, the pressurized water was chosen as being the most advantageous. (W.D.M.)

1814 MND-RP-657-11

Martin Co. Nuclear Div., Baltimore.

ENGINEERING EVALUATION OF LOCAL BOILING IN A PRESSURIZED WATER REACTOR. E. J. Lemanski and J. Jicha. [June 1957]. 11p.

Presented before American Nuclear Society Annual Meeting, Pittsburgh, June 10-14, 1957.

Local boiling in a pressurized water reactor was examined from the aspects of feasibility, desirable operating ranges, limitations, and advantages over an equivalent non-boiling forced convection system. The investigation covered pressures of 600 and 1200 psia and a velocity range of 2-30 ft/sec. Limits such as local boiling burnout and coolant saturation were considered, and desirable ranges of operation are indicated. The results are presented graphically and may be utilized in determining an equivalent non-boiling forced convection system for every local boiling system considered, enabling a thermal and hydrodynamic comparison to be made. It is shown that even if inlet orificing of the local boiling system is employed to prevent flow instability, substantial reductions in pumping power requirements are realized with local boiling. (auth)

1815 NAA-SR-2986

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

DESIGN OF AN EDDY-CURRENT BRAKE FOR A SODIUM-COOLED NUCLEAR POWER REACTOR. R. S. Baker. Sept. 15, 1958. 17p. Contract AT-11-1-GEN-8. $0.75(OTS).

A device known as an eddy-current brake is used to throttle molten sodium flow to prevent excessive thermal stress in the sodium piping of the Sodium Reactor Experiment after the reactor is shut down due to a scram signal. Braking action is provided by a direct-current electromagnet acting across a modified section of 6-inch diameter piping. With power of 2400 watts supplied to the magnet, flow after scram is reduced from 1200 to 12 gpm against the thermal convection driving head of 3 psi. (auth)

1816 NAA-SR-3045

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

SAFETY DEVICE TESTS IN SPERT-I. Stephen H. Fitch and Thomas H. Springer. Oct. 1, 1958. 43p. Contract AT-11-1-GEN-8. $1.50(OTS).

Safety devices designed for application to high-flux reactors such as the Materials Test Reactor (MTR) or to pool reactors were successfully tested in the Special Power Excursion Reactor Test facility SPERT-I. Five safety devices of the "double-diaphragm" type were subjected to severe power transients having reactor periods in the range 110 to 10.1 msec corresponding to excess reactivities of approximately 0.6 to 1.6%. Rapid reactor shutdown was accomplished in each case with large reductions of peak power and energy release. The "double-diaphragm" safety device operates on the principle of changing the configuration of a stored neutron absorbing gas, boron trifluoride, so as to increase its absorption. The gas is stored in a small high-pressure chamber outside the core region; after the device is triggered, the gas expands into the larger receiver chamber located within the core. The trigger is a fission-heated cap soldered to the end of a pressure-release tube. In the event of a reactor excursion or an excessively high level of reactor power, the heat generation is sufficient to melt the solder and trip the device. The tests demonstrated the capability of self-contained, automatic safety devices to produce reactor shutdown under emergency conditions. The transients were terminated at power levels from $\frac{1}{2}$ to $\frac{1}{25}$ of those obtained without safety-device action, with the greatest reduction occurring in the most severe transients. The total energy release, which is an approximate measure of potential damage, was reduced in every case by a factor of ten or more. (auth)

1817 WAPD-TM-116

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

PROP AND JET—A PROGRAM FOR THE SYNTHESIS AND SURVEY OF THREE-DIMENSIONAL POWER SHAPES ON THE IBM-704. J. G. Fairey, J. E. Meyer, J. B. Callaghan, S. H. Meanor, A. V. Pace, and R. B. Smith. May 1958. 101p. Contract AT-11-1-GEN-14. $2.50(OTS).

A description is given of a program which forms the power distribution for a reactor core in three dimensions from previously determined one- and two-dimensional power shapes; the program is written for a 16- or 32-thousand word IBM-704 computer. Thermal data are calculated for various axial traverses, and the results can be sorted to determine the worst areas for further study. The core to be studied may have as many as 100 axial mesh intervals and 25 axial regions. It may have up to 63 radial regions and, depending on machine size, up to 3750 or 6500 interior radial mesh points. As many as 62 of these regions and 3200 or 6000 of the radial mesh rectangles may contain fuel. Thermal parameters may be specified to be different in each radial region. The running time for a problem having 1512 fueled rectangles, 35 axial intervals, 6 radial fuel regions, and 10 axial regions is less than 1-hr total. (auth)

1818 AEC-tr-3435

MEASURING THE THERMAL UTILIZATION FACTOR. (Mesure du Facteur D'Utilisation Thermique). F. Roullier and A. P. Schmitt (Schmidt). Translated by Liz Appleby (General Electric Co. Hanford Atomic Products Operation) from Report CEA-670(J), 1957. 13p.

The thermal utilization factor f, defined as the ratio of the number of thermal neutrons captured in uranium to the total number of neutrons absorbed in the lattice, is measured for the Marcoule G-1 reactor. (W.D.M.)

1819

SELECTING THE REACTOR COOLANT. PART II. SPECIFIC MATERIALS. J. F. Ablitt (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Atomics and Nuclear Energy 9, 355-9(1958) Oct.

Liquid metals, heavy and light water, gases, and organic compounds are considered for use as reactor coolants. The physical and chemical properties of these materials are examined, and applications are proposed by screening the various materials for desired qualities. (J.R.D.)

1820

THERMAL STRESS IN A BARE CYLINDRICAL FUEL ELEMENT OF LARGE SIZE DURING HEATING. W. Kattwinkel. Atomkern-Energie 3, 394-6(1958) Oct. (In German)

Thermal stress distribution in a long cylindrical fuel element without canning is calculated during heating up. Maximum stresses appear in steady state at the surface of fuel element, where σ_Θ (R) = σ_z (R) and both of them are tensile stresses. The last two conditions are fulfilled also in nonsteady state of temperature distribution. (auth)

1821

MUTUAL SHIELDING OF LATTICE PINS IN THE RESONANCE ENERGY REGION. W. G. Pettus and I. E. Dayton (Babcock and Wilcox Co., Lynchburg, Va.). Nuclear Sci. and Eng. 4, 522-9(1958) Oct.

Measurements have been made to determine the effect of mutual shielding on the resonance absorption of neutrons by tightly packed thorium oxide lattice pins. From these measurements, correction factors have been obtained for reducing the results of single-pin resonance integral measurements to the effective lattice values. A comparison of the experimental results with the predictions of the theory of Dancoff and Ginsburg is included. (auth)

1822

HEAT TRANSFER IN A CROSS FLOW NUCLEAR REACTOR. Charles L. Larson (Raytheon Mfg. Co., Waltham, Mass.). Nuclear Sci. and Eng. 4, 607-22(1958) Nov.

The heat transfer between mutually perpendicular fuel and coolant channels of a nuclear reactor is studied for both isotropic and anisotropic conducting media. By means of an electrical conduction analog, a characteristic length of a unit cell of the reactor is experimentally determined for channels of rectangular and circular cross section. Empirical expressions for this characteristic length are given which closely fit the experimental data. A finite difference calculation is used to determine the temperature distribution within a unit cell. (auth)

1823

THE GENERAL THEORY OF CONTROL SHEETS. Bertram Wolfe (General Electric Co., San Jose, Calif.). Nuclear Sci. and Eng. 4, 635-48(1958) Nov.

A general approach to the problem of evaluating the effectiveness in a reactor of plane control sheets is described. A formal expression for the critical equation of a reactor containing plane parallel control sheets is derived under very general conditions. The expression is simplified for cases of practical interest where the sheet spacing is large compared to the smaller of L or $\sqrt{\tau}$. With this limitation explicit and easily soluble, critical equations are derived for thermally black control sheets in a number of interesting arrangements. In particular, the critical equation for a rectangular parallelepiped reactor containing an arbitrary number of equally spaced control sheets placed anywhere in the reactor core is written in easily soluble form. Extension of the techniques to more complicated situations is discussed. (auth)

1824

EFFECT OF IN-PILE LOCAL BOILING ON SURFACE DEPOSITION AND CORROSION. Kurt Katz and Walter E. Hopkins, Jr. (Westinghouse Electric Corp., Pittsburgh). Nuclear Sci. and Eng. 4, 673-89(1958) Nov.

Many advantages can be realized by operating a pressurized water reactor at steady-state local boiling conditions. However, before this mode of operation can be factored into the thermal and hydraulics of reactor design, its effect on cladding corrosion and surface crud deposition must be established. The evaluation of a local boiling test at pH 7, for crud deposition and corrosion is described. (auth)

1825

CAPTURE AND FISSION PATTERNS OF U^{238} IN EBR-I (MARK II). P. Kafalas and R. R. Heinrich (Argonne National Lab., Lemont, Ill.). Nuclear Sci. and Eng. 4, 698-702(1958) Nov.

The capture and fission probabilities of U^{238} were determined radiochemically as functions of horizontal position in EBR-I (Mark II). The ratios $\sigma_c(U^{238})/\sigma_f(U^{235})$ and $\sigma_c(U^{238})/\sigma_f(Pu^{239})$ are presented as functions of horizontal position in the reactor. (auth)

1826

EFFECTIVE-ENERGY METHOD FOR SPENT-FUEL SHIELDING. Ramon L. Ashley (Atomics International, Canoga Park, Calif.). Nucleonics 16, No. 10, 78-81 (1958) Oct.

A simple method which makes it possible to compute the effectiveness of spent-fuel shields with fair accuracy and a minimum of effort is described. It consists in finding an effective photon energy that can be used in place of the spectrum from the spent fuel. The method was applied to shielding of spent U^{235} fuels with four different shielding materials. The results indicate that the method is accurate for cooling times > 45 min, for irradiation times as short as 100 hr. Neglect of low-energy gamma rays limits the application to "thick" shields. (J.S.R.)

1827

REACTOR KINETIC FUNCTIONS: A NEW EVALUATION. G. R. Keepin and T. F. Wimett (Los Alamos Scientific Lab., N. Mex.). Nucleonics 16, No. 10, 86-90(1958) Oct.

The two reactor kinetic functions, the period-vs.-reactivity relation and the zero-power transfer function, were calculated in detail for the six fissionable nuclides U^{233}, U^{235}, U^{238}, Pu^{239}, Pu^{240}, and Th^{232}. Interpolation of the functions obtained for these limiting "pure-isotope" cases will allow estimates for the kinetic behavior of "mixed-isotope" systems. (auth)

Power

1828 AECU-3866

Allstates Design and Development Co., Inc., Trenton. COMPUTER ANALYSIS OF TRANSIENTS IN NUCLEAR REACTOR COOLANT NETWORKS. K. E. Korn, R. C. Jacobsen, and R. O. Woods. June 4, 1958. 88p. For Combustion Engineering, Inc. Nuclear Div. Contract AT(30-3)-198, Subcontract No. 66. $13.80(ph OTS); $4.80(mf OTS).

AECU-3867 supplements information contained in this report.

The results are presented of a project to develop an engineering design tool in the form of a computer program which mathematically represents the transient flow behavior of the S1C nuclear power plant emergency cooling system. The computer program developed represents all the components of a nuclear reactor primary coolant system, including, in this case, six possible flow paths which are partially in parallel and partially coincident. As a design tool, the resultant computer program permits simulation of the transient flow behavior of a very large number of nuclear power plant coolant systems. (W.D.M.)

1829 AECU-3867

Allstates Design and Development Co., Inc., Trenton. COMPUTER PROGRAM FOR TRANSIENTS IN NUCLEAR REACTOR COOLANT NETWORKS. K. E. Korn, R. C. Jacobsen, and R. O. Woods. June 4, 1958. 58p. For Combustion Engineering, Inc. Nuclear Div. Contract AT(30-3)-198, Subcontract No. 66. $9.30(ph OTS); $3.60(mf OTS).

This report supplements information contained in AECU-3866.

The program contains over 1300 equations, and was therefore written in Fortran, an automatic coding system for the IBM-704 computer. The program is described and a listing given. The Fortran variables, subscript code, and nodal locations are described. (W.D.M.)

1830 AECU-3886

Duquesne Light Co., Shippingport, Penna. REPORT ON CHEMICAL TREATMENT OF BOILER WATER. H. A. Klein. July 14, 1958. 39p. $6.30(ph OTS); $3.00(mf OTS).

A review is presented of chemical operations and test results for the period described, comparison of these with prior operation, and discussion of related tests and possible operational changes. Power was produced exclusively through three loop operation using only the 1-A, 1-C, and 1-D boilers. The water pretreatment equipment operated more or less trouble free for the report period. (W.L.H.)

1831 CF-54-8-217

Oak Ridge National Lab., Tenn. FLUID FLOW CHARACTERISTICS OF A HEADER FOR A SINGLE-PASS, CIRCULATING FUEL REACTOR. J. F. Bailey and W. C. Tunnell. Aug. 11, 1954. Decl. Nov. 15, 1957. 39p. Contract [W-7405-eng-26]. $6.30(ph OTS); $3.00(mf OTS).

The results obtained from experimental investigations of the flow characteristics of a header for a circulating fuel reactor are presented. Description of test equipment and graphical and tabular representation of results are included. (auth)

1832 CF-58-9-12
Oak Ridge National Lab., Tenn.
NUCLEAR GAS ENGINE. A. P. Fraas. Sept. 25, 1958. 115p. Contract [W-7405-eng-26]. $18.30(ph OTS); $6.00(mf OTS).

A preliminary design study of the nuclear gas engine, consisting of a gas-cooled reactor directly coupled to a reciprocating engine, is presented. The principles of operation of the proposed gas engine are outlined and typical variations are discussed. The nuclear gas engine is compared with other reciprocating engines and air compressors. A comparison between the ideal and actual cycles is made, with particular attention given to pumping, heat, and other losses to be expected. The applications and development of the nuclear gas engine are discussed. (W.D.M.)

1833 FLR-1
Fluor Corp., Ltd., Whittier, Calif.
SYSTEM EVALUATION OF THE FLOWABLE SOLIDS REACTOR. PHASE I SUMMARY REPORT—FUEL STUDY. R. C. Oliver, H. K. Orbach, M. R. Dusbabek, J. A. Porter, A. Goldstein, and R. H. Bishop. Jan. 28, 1958. 257p. Contract AT(04-3)-131. $4.00(OTS).

The proposed Flowable Solids Reactor (FSR) is a high temperature, circulating fuel, heterogeneous power reactor; the fuel material is a dry, granular solid which flows by gravity through vertical channels in a graphite moderator. Calculations indicate such a system, if practical, could produce power which would be competitive now with conventional steam plants in many areas of the United States. However, the feasibility of such a reactor depends on a number of unknown factors, among the most important of which is the behavior of the fuel material itself under the contemplated conditions. Accordingly, as a first step in the study of system feasibility, an investigation was made into the cost, flow characteristics, and resistance to thermal shock, impact, and radiation damage of certain promising refractory compounds of uranium and thorium. On studying the results obtained, the conclusion was reached that crushed arc-fused UO_2 is the best available material; it is relatively low in cost and has flow and attrition resistance properties such that it appears very promising for use in a Flowable Solids Reactor. Recommendations are made for further work on properties of fuel materials as well as on other aspects of the proposed system which will aid in establishing over-all system feasibility. (auth)

1834 DM-54
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
INITIAL FUELLING OF POWER REACTORS. W. B. Lewis. Aug. 23, 1958. 14p. (AECL-696). $0.50 (AECL).

By following a carefully planned fueling schedule it is possible to save the price of almost half a complete reactor charge of fuel. For power reactors this amounts to a significant saving in the cost of power below the steady rate in the first few years of operation. The saving is derived from the excess reactivity of fresh fuel compared with the average when a fuel change becomes necessary. A practical case of bi-directional slug fueling is evaluated in detail in an appendix. Some pitfalls arising from badly planned schedules are discussed. (auth)

1835 ORNL-2605
Oak Ridge National Lab., Tenn.
GAS COOLED, MOLTEN SALT HEAT EXCHANGER—DESIGN STUDY. R. E. MacPherson. Nov. 14, 1958. 47p. Contract W-7405-eng-26. $1.50(OTS).

One of the major problems in the economic evaluation of the application of forced circulation, gas cooling to high temperature, molten salt power reactor systems is the definition of the required heat transfer equipment, its size and operating cost. A design study of the salt-to-gas heat exchangers for such a gas-cooled system has recently been completed, and the results are reported. Helium, hydrogen, and steam are considered as coolants. The effects of varying heat exchanger tubing size, coolant inlet temperature, coolant pressure level, allowable salt pressure drop and uranium enrichment of the molten salt are demonstrated. The relationship between heat exchanger dimensions, fuel inventory and blower power requirements is presented in graphical form for the most pertinent cases. Comparisons are made of annual operating costs and heat exchanger over-all size as a function of coolant type and operating conditions. Hydrogen is shown to be the most effective of the coolants considered, with steam and helium being roughly comparable. Assuming other conditions to be equal, helium can be made competitive with hydrogen by operating with a 50 to 60% higher helium temperature gradient through the heat exchanger. Optimum heat exchanger geometries based on gas blower costs and enriched fuel inventory charges require a total blower power investment of approximately 0.5% of the plant gross electrical output. However, substantial reductions in heat exchanger size can be realized by going to higher blower power investment levels. (auth)

1836 SCNC-262
Sylvania-Corning Nuclear Corp., Bayside, N. Y.
DEVELOPMENT OF FABRICATION TECHNIQUES AND MANUFACTURING SPECIFICATIONS FOR APPR FUEL PLATES. W. Weinberger. Apr. 1958. 49p. Contract AT-30-1-GEN-366. $1.50(OTS).

The program described consisted of experimental and developmental work that was necessary in establishing a dependable and economical industrial process for the fabrication of Army Package Power Reactor fuel elements. Fabrication procedures and process control were evaluated in order that specifications could be prepared to describe the fabrication process. In addition, one fuel element sub-assembly containing normal uranium oxide was prepared for out-of-pile testing, and one slightly modified sub-assembly containing fully enriched uranium oxide was produced for irradiation testing. (auth)

1837 WAPD-BT-9
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. Aug. 1958. 94p. Contract AT-11-1-GEN-14 and appropriate NObs-Contracts. $2.50(OTS).

Eleven papers are included. Separate abstracts have been prepared for each paper. (W.L.H.)

1838 WAPD-BT-9(p.1-8)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
DISCUSSION OF THE CONSEQUENCES OF LEAKAGE FROM THE PWR REACTOR PLANT. W. R. Ellis and J. R. LaPointe. p.1-8 [of] BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 8p.

Various forms of leakage of coolant water from the PWR primary system have been under study for some time. Although leakage of any type is undesirable, much is unavoidable. The significance and some of the causes and effects of this leakage are discussed, and predicted resultant activity levels are compared with NBS maximum concentrations. (auth)

1839 WAPD-BT-9(p.9-15)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SIZING CRITERIA FOR TANKS AND PUMPS OF A RADIOACTIVE WASTE DISPOSAL SYSTEM. J. M. Randman. p.9-15 [of] BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 7p.

A primary consideration in the design of a radioactive waste disposal system serving a pressurized-water power reactor plant is system capacity. Anticipated operating procedures, site physical characteristics, waste radiological properties, and economic factors must be considered when sizing the system tankage and pumps to provide the desired capacity. This article illustrates how these considerations were factored into the design of the waste disposal system of a large, power producing reactor plant. (auth)

1840 WAPD-BT-9(p.16-19)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
IN-PILE DEPARTURE FROM NUCLEATE BOILING AND PRESSURE DROP TESTING. J. S. Williams, Jr. p.16-19 [of] BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 4p.

During the past year, Bettis Plant tested two highly loaded subassemblies in a pressurized water reactor. This testing was designed to confirm out-of-pile departure from nuclear boiling and pressure drop data. A brief discussion of the various phases of the test program is presented in this general survey. (auth)

1841 WAPD-BT-9(p.20-9)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
APPLICATION OF THERMAL STRESS THEORY TO THE PWR MAIN HYDRAULIC VALVES. D. J. McDonald. p.20-9 [of] BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 10p.

A test was performed to determine the magnitude of the thermal shock to which the cylinders of the PWR reactor coolant loop hydraulically-operated stop valves might be subjected when they are operated. The test is described, and a detailed analysis of the results presented. It is concluded that the installed design is capable of withstanding the number of shock cycles expected over the lifespan of the plant. (auth)

1842 WAPD-BT-9(p.30-8)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SURVEY OF BETTIS PLANT GASKET EXPERIENCE AND TESTS. R. L. Maier. p.30-8 [of] BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 9p.

This summary of Bettis Plant gasket experience was prepared to provide a basis for judging the adequacy of gaskets for nuclear pressurized water reactor plant service. Leakage rate measurements were made under controlled water and actual plant operating conditions on a wide variety of commercially available gaskets in both threaded and bolted flange joints. The spiral-wound stainless steel and asbestos gasket was found to be best for use in a bolted flange or union joint closure. (auth)

1843 WAPD-BT-9(p.39-50)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
ANALYSIS OF A SIMULATED COLD WATER INCIDENT IN PWR. W. J. Gallagher. p.39-50 [of] BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 12p.

If coolant at a temperature significantly below the average of the inlet temperature of the coolant in the other three loops is introduced from one loop of PWR into the reactor, core damage can occur. An analysis of such a cold water incident was accomplished through the two series of DC analogue computer simulations described herein. The various effects considered in the interpretation of this analysis are explained, and results show that fuel pellet melting is the limiting factor. (auth)

1844 WAPD-BT-9(p.51-9)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
DIMENSIONLESS FORM FOR COMPLETE-LOSS-OF-FLOW PARAMETERS. J. E. Meyer. p.51-9 [of] BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 9p.

Analyses of reactor behavior during complete-loss-of-flow incidents are quite useful in reactor safety evaluations. Several dimensionless parameters are presented which describe the reactor characteristics of major importance in such analyses. These parameters may be used for efficient choice of numbers during parametric studies and for estimating the effects of small design changes. (auth)

1845 WAPD-BT-9(p.60-8)
Westinghouse Electric Corp. Research Labs.,
East Pittsburgh, Penna.
PHOTOELASTIC ANALYSIS OF STRESS IN AN UNPERFORATED, FLANGED, HEMISPHERICAL PRESSURE VESSEL HEAD. R. C. Sampson. p.60-8 [of] BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 9p.

Part of a general Bettis Plant program on photoelastic investigations of pressure vessel heads with perforations is described. This particular portion of the program treats a thick hemispherical head without perforations and establishes the basic stresses in such a head. The information contained should be helpful in providing insight into the sources of high stress in a head of this type. (auth)

1846 WAPD-BT-9(p.69-77)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
DISCONTINUITY STRESSES IN THIN-WALLED CYLINDRICAL BODIES. R. A. Oerth and A. J. Martenson. p.69-77 of BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 9p.

A method was needed to calculate the magnitudes and effects of local bending stresses in thin-walled cylinders in regions of discontinuity. Such stresses are encountered where pressurized tubes are closed off or where they have abrupt changes in wall thickness. A general method for such calculations is presented and a detailed problem is solved as an example. (auth)

1847 WAPD-BT-9(p.78-83)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
A THIN CYLINDER UNDER SEMI-INFINITE OUTWARD RESTRAINT. C. M. Friedrich and S. J. Becker. p.78-83 [of] BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 6p.

Analogously to some problems in beams and plates, the problem of the symmetric axial bending of a cylinder sometimes includes the supplementary problem of determining the location of a boundary. Here, an infinitely long cylinder with internal pressure has a semi-infinitely long radial restraint which restricts the expansion of the cylinder to a pre-determined maximum. Formulas describing the stresses and deflections involved are developed, and an example is employed to illustrate the use of these formulas. (auth)

1848 WAPD-BT-9(p.84-7)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
MOMENT DISTRIBUTION IN VIERENDEEL TRUSSES.
A. J. Martenson. p.84-7 [of] BETTIS TECHNICAL REVIEW. REACTOR AND PLANT ENGINEERING. 4p.

Although a vierendeel truss is a simple structure it often presents stress-analysis problems since it is statically indeterminate. An analysis of the more complex problem using a digital computer is presented. It is pointed out that these results from a digital computer can be further extrapolated by hand. (auth)

1849 WAPD-EM-196
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
PWR REACTOR CONTROL SYSTEM REQUIREMENTS.
T. J. Walker and N. E. Wilson. Mar. 1, 1954. Decl. May 9, 1957. 15p. $3.30(ph OTS); $2.40(mf OTS).

A discussion and definition of PWR control requirements based on basic reactor control and station operational requirements are presented. Quantitative considerations of reactivity adjustment in reactor start-up, power level control, and reactor shutdown are discussed. The feasibility of chemical control or rod and chemical programming are not considered. (J.R.D.)

1850 WAPD-PWR-PC-249
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
PRIMARY PLANT ELECTRIC POWER DISTRIBUTION SYSTEM; D-C DISTRIBUTION SYSTEM. William P. DiPietro. [nd]. 4p. $1.80(ph OTS); $1.80(mf OTS).

The d-c power distribution system for operating control devices and emergency lighting during loss of a-c power to the Shippingport Pressurized Water Reactor is described. (T.R.H.)

1851 WAPD-PWR-PC-1569
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PWR REACTOR AND REACTOR PRIMARY COOLANT SYSTEM TRANSFER FUNCTIONS. E. A. Wieczorkowski. [Oct. 1958]. 23p. Contract [AT-11-1-GEN-14]. $4.80(ph OTS); $2.70(mf OTS).

The PWR reactor and primary coolant system were studied on an electronic analog simulator with the independent parameter (control rod position) varied sinusoidally with fixed amplitudes at different frequencies of oscillation. From the simulator results, transfer functions of the system were obtained and log-frequency plots were developed. The resulting variations in dependent plant parameters were also plotted as a function of frequency. (auth)

1852 YAEC-99
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
MONTHLY PROGRESS REPORT FOR THE PERIOD SEPTEMBER 1 TO 30, 1958. R. W. Garbe and H. E. Walchli. Oct. 20, 1958. 17p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $3.30(ph OTS); $2.40(mf OTS).

A 95-inch experimental Yankee sub-assembly was successfully brazed at 1890 ± 10°F for three hours then furnace cooled. All of the joints, outside ferrules, and control rod rubbing strips showed a brazed fillet. Dimensional surveys and joint strength studies indicate that two brazing techniques appear feasible for subassemblies. Codings for computers for use in core design problems are described. A series of criticality calculations for the three water-to-metal volume ratios of the Yankee critical experiments was concluded with the calculation of the critical mass of a 4:1 water-to-uranium metal volume ratio core. Calculations were performed to determine the Mwd/t burnup in terms of unperturbed nvt for 2.7 and 5.4% enriched process water test specimens. Temperature stability experiments were conducted on Rohm and Haas XE-150 resin by means of water baths at the purification system operating temperature of 140°F and at an elevated temperature of 170°F. Data were obtained on corrosion of construction materials. A study was made of the reaction of soluble oxygen with hydrazine in borated water. Performance of criticality experiments on stainless steel clad UO_2 fuel elements at various water-to-metal ratios are reported. (For preceding period see YAEC-95.) (W.D.M.)

1853 AEC-tr-3421
THE RELEASE AND INDUSTRIAL UTILIZATION OF ATOMIC ENERGY. J. P. Ricard. Translation of Lecture Delivered at "L'union des ingenieurs de France" [The Society of Engineers of France.] 23p.

Nuclear theory is reviewed. Applications of nuclear energy for power production are discussed with emphasis on the propulsion of nuclear submarines. (C.H.)

1854
THE ECONOMIC PROBLEMS OF NUCLEAR POWER.
J. A. Jukes (United Kingdom Atomic Energy Authority). Atom No. 24, 17-28(1958) Oct.

At the present economical nuclear power is possible only in certain circumstances and by using only one or two of the very large number of systems which are technically possible. The development problems presented by the economically feasible systems such as the gas-cooled, graphite-moderated reactor are discussed. The economic and time aspects of the development are emphasized. (J.S.R.)

1855
ATOMIC ENERGY PROPULSION FOR AIRCRAFT.
J. W. Shortall. Atomkern-Energie 3, 397-401(1958) Oct. (In German)

The first part of a paper on the development of nuclear propulsion for aircraft is presented. The power plant, radiation protection, and shielding are discussed. (J.S.R.)

1856
NUCLEAR POWER AND THE ENGINEER. Christopher Hinton. Nature 182, 1047-51(1958) Oct. 18.

The development of nuclear power in Great Britain is reviewed. It is pointed out that the industrial use of nuclear power cleared its first hurdle in 1956 when Calder Hall went into operation. It must clear its second hurdle with equal success in 1966 with reactors of advanced design built at a capital cost so low that they are able to share in carrying peak loads of the production of electricity. (C.H.)

1857
RECENT DEVELOPMENTS IN NUCLEAR ENGINEERING. John Cockcroft. Nature 182, 1334-7 (1958) Nov. 15.

Recent developments in nuclear engineering are reviewed as revealed at the second Geneva Conference on the Peaceful Uses of Atomic Energy. (C.H.)

1858
THE KINETICS OF CIRCULATING FUEL REACTORS.
John MacPhee. Nuclear Sci. and Eng. 4, 588-97(1958) Oct.

Various methods of approximating the kinetics of circulating fuel reactors are investigated. As the basis for comparison, a relatively exact model is used, predicated on perfect mixing in the core and slug flow in the external loop. The derivations and applicability of the various approximate methods are presented. It is shown that the frequency response of the exact model can exhibit peaking (i.e., resonances). The effect of such peaking on the transient response of the system is illustrated. The possibility of self-sustained oscillations of reactor power, resulting from the feedback caused by delayed neutron precursors re-entering the core, is also discussed. (auth)

STABLE ISOTOPE SEPARATION

1859
STABLE ISOTOPE DILUTION, CHEMICAL ANALYSIS BY MASS SPECTROMETRY. R. K. Webster. Ind. Chemist 34, 495-501(1958) Sept.

Chemical analysis by mass spectrometry is discussed with emphasis on elements that can be analyzed and production of their tracers, interference, contamination, performance, and chemical isolation of the element. The main value of the method appears to lie in determination of trace concentrations; or higher concentrations when only very small samples are available. (J.R.D.)

1860
THERMAL DIFFUSION FACTORS FROM COLUMN OPERATION. T. I. Moran and W. W. Watson (Yale Univ., New Haven). Phys. Rev. 111, 380-3(1958) July 15.

Extending the measurements of Corbett and Watson, the performance of a carefully-constructed, all-metal, hot-wire thermal diffusion column was determined for isotope separations in neon, argon, krypton, and xenon. The same quantitative agreement with theory for normal argon gas at the low wall-temperature ratio of 2 is again found. This is probably fortuitous, for in general there is a discrepancy between the calculated and observed separation factors, with a trend in the data indicating that the assumptions of the theory that (1) the molecules are Maxwellian and (2) the thermal diffusion factors are constant, independent of temperature, are at fault. (auth)

1861
THE ELECTROLYTIC HYDROGEN-DEUTERIUM SEPARATION FACTOR AND REACTION MECHANISM. B. E. Conway (Univ. of Ottawa). Proc. Roy. Soc. (London) A247, 400-19(1958) Sept. 30.

The theory of the electrolytic separation factor (S) for H and D is examined for various rate-determining mechanisms in the cathodic hydrogen evolution reaction. Isotopic differences of all relevant thermodynamic quantities and partition functions for the reacting entities are taken into account in the calculation of rates of pairs of isotopically analogous reactions. Values of S characteristic of various mechanisms and conditions are obtained, and it is shown that the value arising if electrochemical desorption of adsorbed H or D is rate determining is 6.1, while that for simple discharge of hydroxonium ions is 3.0. The experimental data for S are readily divisible into two groups having, respectively, values close to these two figures. The values of S predicted theoretically for selected metals, assuming the rate-determining mechanism indicated by independent experimental criteria, are in agreement with the values of S measured experimentally for these metals. S is examined as a function of D_2O content of the solution in limiting cases. The ratio of rates of D and H production from solutions in pure D_2O or H_2O, respectively, is characteristic of reaction mechanism. Anomalies in the theory of proton discharge and isotope separation from alkaline solution are discussed. (auth)

TECHNOLOGY

Feed Materials

1862 KY-265
Union Carbide Nuclear Co. Paducah Plant, Ky.
RECOVERY OF URANIUM HEXAFLUORIDE FROM A GAS STREAM BY ABSORPTION IN A FLUIDIZED BED OF URANIUM TETRAFLUORIDE. J. L. Powell, W. R. Foreshee, and S. Bernstein. Oct. 31, 1958. 16p. Contract W-7405-eng-26. $0.75(OTS).

A unique absorption process for recovery of small quantities of uranium hexafluoride vapors from a highly reactive gas stream is discussed along with the design criteria that were developed as a result of laboratory and pilot plant tests. The chemistry of the absorption process is presented with a summary of the data collected during laboratory and pilot plant testing. A description is also given of the plant scale absorption system now in operation at the UF_6 manufacturing plant of the Union Carbide Nuclear Company at Paducah, Kentucky. The vent gases from the UF_6 manufacturing process at Paducah contain appreciable quantities of oxygen and nitrogen, some hydrofluoric acid and elemental fluorine, and small quantities of valuable uranium hexafluoride. To permit recovery of the UF_6, these vent gases are passed through a fluidized bed of green salt (uranium tetrafluoride) where essentially all of the UF_6 and a portion of the F_2 react to from solid uranium fluoride intermediates. When operated at 400°F, as much as 0.38 pounds of UF_6 or its equivalent of F_2 can be absorbed per pound of green salt. The green salt containing the absorbed UF_6 and F_2 can either be returned to the UF_6 manufacturing plant or regenerated with hydrogen. (auth)

1863 TID-5342
Vitro Mfg. Co., Pittsburgh.
SCRAP RECOVERY AT VITRO MANUFACTURING COMPANY, CANONSBURG, PENNSYLVANIA. D. L. Vives. Mar. 1951. Decl. June 9, 1958. 26p. (M-5482). $7.80(ph OTS); $3.30(mf OTS).

A process is presented for recovering U_3O_8 from scrap residues varying in content from 2 to 85% U_2O_8 to yield a high-purity (99% U_3O_8) black oxide. (W.L.H.)

Raw Materials

1864 CF-55-11-130
Oak Ridge National Lab., Tenn.
THE ION EXCHANGE-EXCER PROCESS FOR THE PRODUCTION OF METAL GRADE UF_4 FROM CRUDE URANIUM SOURCES. I. R. Higgins. Nov. 29, 1955. Decl. Sept. 26, 1958. 8p. Contract [W-7405-eng-26]. $1.80(ph OTS); $1.80(mf OTS).

Discussions of the Higgins countercurrent exchanger for partially purifying crude product and an ion exchange conversion of crude uranium solutions to UO_2F_2 with subsequent electrolytic reduction to UF_4 are presented, with the emphasis on production of high-purity metal at the uranium ore mill site. The process may be divided step wise into anion exchange isolation, cation conversion, and electrolytic reduction. (J.R.D.)

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